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[NOTICE.]

Wrinkle Department, American Gas Institute.

WRINKLE DEPARTMENT, AMERICAN GAS INSTITUTE,
OFFICE OF EDITOR, GAS OFFICE BUILDING,
DETROIT, MICH, March 12th, 1909.

To the Members, American Gas Institute: All members of the American Gas Institute are earnestly requested to forward contributions for the Wrinkle Department as soon as possible.

Your co-operation determines the success of the Department.

F. L. CROSS, Editor.

[NOTICE.]

Fourth Annual Meeting, Natural Gas Association of America.

NATURAL GAS ASSOCIATION OF AMERICA,
OFFICE OF SECRETARY,
DELAWARE, O., March 8th, 1909.

You are most cordially invited to attend the Fourth Annual Meeting of the Natural Gas Association of America, to be held in Columbus, O., May 18th, 19th and 20th, 1909.

The meetings will be held in Assembly Hall, Great Southern Hotel, the headquarters. The Great Southern is conducted on the American plan, and the following rates have been secured for the meeting—$2.50 to $5 per day. The most satisfactory quarters are always obtained by writing in advance to the hotel people, who will put forth every effort for the comfort of the Association.

The Governor of Ohio, Hon. Judson Harmon, will welcome the Association at the opening of the meeting.

A most interesting feature will be an exhibition of gas appliances.

The technical programme of the meeting is being compiled, and will be sent out later by the Secretary of the Association.

It may be that you are not a member of the Association, and, in soliciting you to become a member, we are not offering you a grand opportunity for disappointment, nor is there the least element of chance in the matter. You can submit your application at the meeting, but you will be showing the Association considerable courtesy and doing yourself a good turn should you sign and send in at once the inclosed application blank.

Columbus is a most attractive convention city, and the Committee on Local Arrangements will do all in their power to entertain all those who attend the meeting.

T. C. JONES, Secretary,
Committee on Local Arrangements.

BRIEFLY TOLD.

PRESIDENT CORTELYOU.—Those in charge of the ways-and-means avenues of the Consolidated Gas Company are seemingly agreed that Mr. George H. Cortelyou, former Secretary of the Treasury during the Roosevelt regime, and whose election to the Presidency of the Consolidated Gas Company was accomplished the last week in October, has assumed charge of its vast interests in a manner that indicates that the position is not too big for him. It was likely such a verdict would be reached, in that during his services to the ex-President he was neither taskmaster nor scold. Thoroughly imbued with the belief that diplomacy is often as useful as swashbuckling, in forwarding the cause of anyone or anything, he appears to have assumed control of the civil affairs of the Consolidated with no desire to figure as a central "I am." Quite to the contrary he is good enough soldier and true enough Long Islander to know that a house in peace is a mine of wealth. To the credit of his aides, be it said, Mr. Cortelyou has received and will receive the unqualified support of the men whose services to the army of shareholders in the Consolidated Gas Company, in the trying year through which they have passed, cannot be repaid in coin. And it speaks well for the future of a company in whose service may be counted such men as Walter R. Addicks, W. H. Bradley, Dr. J. A. Bennet and R. A. Carter. Meanwhile, to again revert to the homely adage, "All's not lost that's in danger," it might be well to remember that in the near future a readjustment of the Company's multifarious interests is likely to result in a return to the shareholders of the famous 6 per cent. first interest decision. To come back to the real subject in hand, if loyalty to a commander will be of assistance to such commander, President Cortelyou may count on such assistance to a man of his present aides and working brigades.

THE SOUTHWESTERN ELECTRIC AND GAS ASSOCIATION.—At a meeting of the Executive Committee of the Southwestern Electrical and Gas Association, which was held in Dallas, Tex., the morning of March 16th, with President R. B. Stichter in the chair, much active business was transacted. Among other things that transpired the next meeting time was fixed for May 20th, 21st and 22d, Dallas being the place. The Committee reported that matters in connection with the prelimi-

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naries for the Dallas meeting were in forward state; declared the office of Secretary to be vacant; the names of 8 active and 6 associate members were recommended for election; and it was also decided that this year's "Souvenir Programme," which is promised to be a decidedly gorgeous affair, should have bound up with it the questions contained in the question box. The Treasurer reported a balance on hand of $1,167.02, which brought forth the remark from brother W. B. Tuttle, of "San Antone," that "that was hiding some."

CURRENT MENTION.—

"DEAR JOURNAL: The U. G. I. Company's annual convention of Managers, Engineers and Superintendents, which was held in Philadelphia last month according to programme, was perhaps the most interesting of the many interesting reunions held by the Company's staff. The sequel or rather the corollary offered by the technical sessions was most handsomely framed in an outing to Atlantic City. Headquarters were in the Hotel Shelburne, and the direct management of it all was in the capable hands of Vice-President Paul P. Thompson. I could give you vastly more about the doings, both in the convention hall and at the seaside, which would make most interesting reading; but, respecting the wish of the Company to keep these matters quite to its own records, let me take leave of it in the remark that the Parent Company is in no wise niggardly in the treatment of its men.—V. R."

MR. H. M. BUEGLER, formerly Superintendent of the electric division of the properties of the Elmira (N.Y.) Water, Light and Railway Company, has been named to take charge of the Beal artificial lighting properties in New York. His headquarters are to be in Newburgh.

MR. F. W. LITTLE, of Minneapolis, Minn., who is said to be the main one in interest in the ownership of the Sault Ste. Marie (Mich.) Gas and Electric Company, announces that an expenditure of $25,000 will be forthwith made in putting the plants in proper shape. The main system is to be increased in the sum of 35 per cent. In the reorganization of the Company the following result was reached: President, F. W. Little; Secretary and Manager, J. H. More; Directors, F. W. Little, R. G. Ferguson, J. H. More, R. S. Wallace, B. J. Clergue; Superintendent, C. W. Murphy.

"R. F. S.," writing from Bridgeport, Conn., under date of the 24th ult., says: "The extension of its piping system by the New Haven Gas Light Company to the outlying village of Milford (famed in Connecticut's history for well over 1½ centuries) will bear good returns, for the Selectmen of Milford have already agreed with the New Haven Company to 'take and pay for a term of 3 years' a number of street lamps, not less than 100, however, of the mantle type, as used in the lighting of the streets of New Haven. The Company is to maintain, light, extinguish and furnish gas on the basis of a payment of $25 per lamp per annum, plus $1 rental for each post, which posts remain the property of the New Haven folks. Just think of it! Bridgeport could have all this and more if it were not satisfied to move along so complacently. Next in order should come the news that beautiful old Stratford—also of historic memory—and still nearer to Bridgeport than Milford is—has closed a contract for its public lighting with Mr. Nettleton's Company."

THE Lowell (Mass.) Gas Light Company is considering the advisability of extending its main system to and through the outlying districts of Woods' Corner and Tyngsboro. Truly, these are piping times.

MUCH comment is being made upon Chapter 173, a law enacted by the current Massachusetts Legislature, and which received the Governor's approval the 16th ult. So writes a correspondent in Troy, N. Y., who asks what is particularly underway in artificial lighting circles of Massachusetts that required the passage of an act in terms so cabalistic. We are unable to reply to the query, and, therefore, ask any of our readers who are posted thereon to solve it for our inquirer and ourselves. The text of the Bill is:

SECTION 1. A city or town which has acquired a plant for the manufacture or distribution of gas may purchase gas from another city or town or from any corporation manufacturing gas; and a city or town which has acquired a plant for the manufacture or distribution of electricity may purchase electricity from another city or town or from any corporation manufacturing electricity.

SEC. 2. Seciton 18 of chapter 34 of the Revised Laws is hereby repealed.

SEC. 3. This act shall take effect upon its passage.

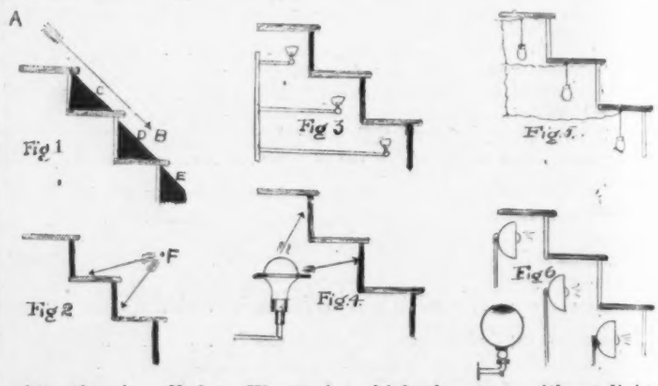
AT the annual meeting of the Western United Gas and Electric Company, held in Aurora, Ills., the afternoon of March 24th, Directors elected were: W. S. Beaupre, C. E. Colwell, I. C. Copley, E. S. Hobbs, J. O. Mason, S. D. Seamans, C. C. Smith, R. N. Strohn, Fred. Bennett, John C. Lowry and Morris W. Stroud. The Directors subsequently appointed the following executive management: President, I. C. Copley; Vice-President and Treasurer, R. N. Strohn; Secretary, Fred. Bennett; General Manager, H. L. Rice.

Stair Lights.

[Communicated by "R."]

Exceptional efforts are being made in the direction of stair lights, which seems queer in that not very much attention had been given to the scientific side of step-lighting in the past. Various designs of lights have been introduced, calculated to spread more or less illumination over the front, sides, top or other parts of the steps of houses, halls, mills, public buildings and exterior service in parks and at porches. Lighting engineers have undertaken various forms of step-lighting, with the result that some very perfect systems of stair lighting have been introduced. The gas lighting engineers have patterned systems of pipes and globes by which light is transmitted to points most desirable for effecting the end sought for. The gasoline people have introduced vapor and various forms of pressure lights for this work, and electric lighting companies have not overlooked the opportunity presented by the stair lighting field. Many modern architects require plans of network of pipes or wires for conveying light to designated points in steps which steps it was not considered necessary to illuminate in the past. Mill owners have added step-lighting to ordinary darkened passages, for the reason that some corporations were obliged to pay damages to employees who were injured by falling down darkened stairs. In the houses of private citizens, where formerly dark stairways existed, may be found lighted ones for the accommodation of the persons who pass up and then down the flights.

Some of the commercial houses have taken advantage of the step-lighting and have introduced plans for advertising wares. The illuminated step front is fixed with the necessary lines of bold-face type to show an "ad."



Attention is called to Fig. 1, in which the steps without lights usually present a line of shadows, from *A* to *B*, in the spaces *C*, *D* and *E*, and so on to the bottom. In the event that there is plenty of sunlight, or if the lighting equipment is such that the light strikes the front of the steps, like *F*, Fig. 2, then special lighting is not necessary; but it often happens that the steps face from the sunlight or the artificial light and the dangerous shadows result. Persons fall by tripping on the steps. The department stores often have a number of damage suits in hand because of patrons tripping on improperly lighted steps, hence we find that the gas and electric lighting engineers are giving special notice and time to the development of lighting steps in such manner that there can be no way for the people to make missteps because of poor light. The introduction of the plate glass steps has been a stride in the desired direction. Then, again, in some designs of lighting steps, the front of the step is the only transparent part. Sometimes the lighting is accomplished through the bull's-eye pieces of glass set into openings in the body work of the steps on top or the front or both. Fig. 3 shows how one party is lighting his steps with ordinary gas jets. The fronts of the steps are plate glass, sanded. The tops are slabs of metal, so there is no danger of fire unless foreign matter is allowed to gather.

It is something of a bother to have a number of jets to light; hence another man uses a gas arc, the lighting power of which is ample to shoot the rays to the glass step fronts, as indicated by the arrows in Fig. 4. Another party has put in a tier of electrical globes, as in Fig. 5. Still another has adopted the plan shown in Fig. 6, which involves the use of both gas and electricity. First the series of 6 electrical bulb lights were strung, and, as the plate fronts of the steps were of thick, green bottle glass, it was found necessary to put in the reflectors; but the latter did not make the light bright enough for effective lighting, hence the gas arc was put in and used with the electrical lights,

the combination resulting in properly lighting the steps. But as it is best to make the proper beginning, use transparent plate glass. The glass need not be pure white, for then the light might be too blinding; but grounded surfaces, stained, or designed glass will do. Glass bearing advertising matter can be introduced.

To my mind a big field is opening for the lighting world in the step illuminating business. I have noticed that some of the cement step manufacturers are molding steps with apertures designed for adjusting glass so that the steps can be lighted. Old steps can be overhauled and lights introduced. Speaking with one man, he told me he intended to take the road with a step-lighting equipment and take contracts for introducing lights in steps already in position.

[Proceedings, as Furnished by the Secretary.—Continued from page 405.]

PROCEEDINGS, THIRTY-NINTH ANNUAL MEETING, NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.

Held in Young's Hotel, Boston, Mass., Feb. 17, 18, 1909.

First Day—Morning Session.

The President called for the

Reports of Secretary and Treasurer,

which were presented by Mr. Gifford. In substance these were: As Secretary he reported that there were on the rolls the names of 228 members, of whom 5 were honorary, 139 active and 84 associate. During the year the Proceedings of the meetings held in the years 1906-07-08, have been printed in a single volume and distributed to the members.

As Treasurer, Mr. Gifford reported that the cash on hand January 1, 1908, amounted to $241.74; that the receipts during the year, with cash on hand, amounted to $1,900.57, the payments to $1,591.76, and the balance on hand (January 1st) was $673.20. The reports bore the testimony of the Auditing Committee that the statements contained therein were correct. On motion of Mr. Snow the reports were accepted.

Correspondence, Letters of Regret, Etc.

The Secretary—Here is some of the correspondence, mostly regrets, the acceptances I thought it unnecessary to bring in. Perhaps you will allow me to read most of these by signature only: Gen. Morris Schaff, A. R. Mead, I. C. Copley, T. E. Byron, Lewis Lillie, A. S. Miller, Walton Forstall, H. L. Rice, C. H. Corbett, A. P. Ewing, A. B. Eaton, C. B. Strohn. One from Col. Benson perhaps I might read. It is dated Brooklyn, Feb. 15:

"I regret to say a business appointment of importance, on the 16th inst., will prevent my attendance at the annual meeting of the Association, which I had fully intended to do. Please remember me to all inquiring friends and accept my best wishes for the most satisfactory and enjoyable meeting the Association has ever held.

"Yours, sincerely, Fred. S. Benson."

A. B. Beadle refers to experiences which happened in Massachusetts, B. N.—In a footnote he says the latter stands for Before Nute. Others are from Rollin Norris. J. C. D. Clark, and possibly some have escaped the bunch.

The President—Under the heading "Reports from Committees," we will have the

Report of Committee on Uniform Accounting and Operation,

which was read by Mr. W. H. Gardiner, as follows:

Pursuant to instructions given it at the meeting a year ago, your Committee has co-operated with the Committee on Uniform Accounting of the American Gas Institute. It has confined its work to such co-operation rather than attempting to draw up an independent classification of its own, feeling that such a classification might not materially advance the art of uniform accounting and would not add to the general harmony of the situation. And this more particularly because each official body concerned, which has put forward a classification, has done so in terms more or less divergent from all other classifications. While it is to be hoped that from these systems of uniform accounting a national one will be evolved, signs are not lacking or that various systems may develop on lines of even greater difference than now used.

Your Committee, in response to an invitation, attended an important conference on uniform accounting, held in New York, March 26, 1908, before Commissioner Maltbie, of the Public Service Commission of New York, after having during the previous week devoted practically its entire time to discussions and conferences with various bodies and individuals interested. At the conference before Commissioner Maltbie were representatives of the Inter-State Commerce Commission, the Massachusetts Board of Gas and Electric Light Commissioners, the Wisconsin Railroad Commission, the New York Public Service Commission, Second District, Committee on Uniform Accounting of American Gas Institute, Committee on Uniform Accounting, National Electric Light Association, the Empire State Gas and Electric Association, your own Committee on Uniform Accounting, and many other individuals, representing interests in widely separated parts of the country.

The tentative classifications previously given out were freely discussed, item by item, in principle and in practice, and as a result were revised in several respects. Your Committee has collected in one volume all the classifications for uniform accounts of gas and of electric light undertakings, as since officially issued by the New York Public Service Commissions for the First and Second Districts, and by the Wisconsin Railroad Commission. This volume we desire to file with your Secretary for your use.

In view of the co-operative relations existing between your Committee and others more directly concerned in these classifications, your Committee feels itself constrained not to enter into a more or less elaborate analysis and comparison of these several classifications. We may, however, call attention to the great attention paid to the depreciation or amortization accounts and to the segregation of "maintenance" from "production" in the operation accounts. In our report to you a year ago we called attention to the undesirability and impropriety of one intent of the legal clauses prescribing uniform accounting. These were to the effect that the Commissions should establish a system or systems of uniform accounting and that thereafter the companies should not keep any other or supplemental accounts.

Your Committee repeatedly pointed out that the enforcement of this provision regarding supplemental accounts would retard the development of the arts of management and accountancy, but that the real intent of the law could be satisfied by having all supplemental accounts brought to the notice of the Commissions.

We, therefore, note with interest that each Commission has authorized the carrying of supplemental accounts, each of such accounts being designated and open to inspection. Respectfully submitted,

W. H. Gardiner, Chairman,
J. J. Humphreys,
Edmund Cathels,
} Committee.

Supplemental to the above, Mr. Gardiner mentioned: This, gentlemen, is the volume on uniform accounting. I might add to the official report that the year which has passed, it seems to us, has been an epoch making year in uniform accountancy. We have had these very large conferences of interests very widely separated in different parts of the country. The two New York Commissions and the Wisconsin Commission, both comparatively new to the field of public supervision, have inaugurated and put in effect, as of January 1st, 1909, their individual systems of uniform accounting. These, as you can judge from the magnitude of this book, are elaborate. We hope that their practice will prove them to be excellent, although a number of officials have quite frankly said they expected from time to time to revise various items, and in fact are considering keeping in touch with the companies in order to develop such revision along the best lines. I trust those of you interested in this subject will call on the Secretary for this volume. We naturally felt a little diffident about reprinting it, so we simply collected one set of copies from the various Commissions and had them bound.

The President—Gentlemen, you have heard the report of your committee. What action will you take on it?

Mr. Snow—I move it be accepted, and the committee discharged. [Seconded.]

The President—It is moved and seconded that the report of the committee be accepted and placed on file, and the committee discharged. Are there any remarks?

Mr. Nettleton—I would like to add to that, with "the thanks of the Association." It seems to me, from Mr. Gardiner's report, that the Committee have done a large amount of work and did it very well indeed.

The President—We will include in the motion the thanks of the Association. [Adopted.]

COMMITTEE ON NOMINATION OF OFFICERS.

The President appointed, as a Committee for nominating officers, Messrs. Prichard, Richardson and Kennedy.

The President introduced Mr. R. E. Wyant, of New Haven, Conn., who read the following paper on

SOME RESULTS OF THE USE OF STEAM AND AIR METERS IN THE WATER GAS PLANT.

There are few processes more simple in conception than that involving the manufacture of water gas, and, yet, for the past 20 years, no other part of the gas business has been given more careful study. Hundreds of technically trained workers have been engaged in the development of all phases of the subject, and, as a result, we have to-day greatly improved apparatus and methods of operation, together with a large amount of exact information. In a subject so vast these few notes make no pretence to a scientific discussion, nor does the author make any claim to originality. The intent is to place before you a few practical observations regarding the use and application of steam and air meters in connection with water gas apparatus. While an elementary statement of the process is simple, the practical difficulties are many and often perplexing. The process gives rise to many variable conditions which seriously interfere with successful operation of the plant, and a consideration of the improvements in apparatus and in methods of operation will show that the most important of these improvements are concerned with the elimination of these variable factors.

Lest, by association, we have grown accustomed to think of the variable conditions as a necessary part of the water gas plant, or, by elimination, we have forgotten them, let me recall some of the variable factors that have to be met.

1. Quality of fuel.
2. Varying quantities of moisture in the same or different fuels.
3. Temperature of fuel bed.
4. Variations in quantity of air supplied to generator and carburetter.
5. Changes in atmospheric conditions.
6. Resistance of fuel bed to passage of air and steam.
7. Uneven temperature in fuel bed, and formation of "Dead eyes."
8. Variations in the quantity of steam used.
9. Depth of active fuel bed.
10. Position of fire zone.
11. Proportion of down runs.
12. Faulty cleaning of fire and reduction of grate area by side clinker.
13. Variations in the cycle of operation.
14. Time consumed in putting on and taking off runs.
15. Variable temperature of carburetter and superheater.
16. Variations in quantity, rate and distribution of oil.

This list is by no means complete, but I think it will serve our present purpose. We may have some of these variables or we may have them all in combination.

With so many variables to reckon with, is it any wonder, even in the most carefully operated plants, that there are occasional off days? If the finest plants fail in perfect regularity of operation, what shall we say of the plants in which these uncertain quantities are not systematically disposed of? The practical problem before us is to eliminate these variables to the fullest extent, for it is perfectly plain that we cannot turn out a uniform product if the constituent parts of that product come along in varying quantities. Neither can we produce the maximum quantity of gas with the minimum quantity of materials, unless we follow with perfect regularity that cycle of operations found most efficient.

Referring to our list of variable conditions, No. 1 can be quickly determined by analysis, No. 2 is far more important in the case of coke than of coal, and can be readily determined by drying samples and weighing the moisture lost. For practical purposes the moisture can be compensated for by more generator air blast. Nos. 3, 4, 5, 6 and 9 are wholly or in part connected with the air blast and in so far, can only be eliminated by measuring the quantity of air supplied to the generator. No. 7 may be due to the steam supply, quality of fuel, bad cleaning, or a number of things in combination for which no general remedy can be given. Nos. 3, 6, 8, 10 and 11 are dependent upon or connected with the steam admitted to the generator and require some means of measuring or gauging the quantity of steam used. Nos. 9, 12, 13, 14, 15 and 16 are especially dependent upon the faithfulness of the gas maker, in carrying out the scheme laid down. Nos. 9, 10 and 11 have so important a bearing on the whole process as to require brief mention before discussing the subject further.

Immediately after cleaning, ash begins to form throughout the fire, but more especially near the grate bars. To maintain a uniform depth of active fuel, the bed must be gradually raised to take the place of the ash formed. In a 12-hour run from 18 inches to 24 inches of ash are usually formed, so that the height of the fire should be raised by this amount during the shift.

The use of down-runs fills a double purpose: First, in promoting the formation of ash low down in the generator and in depressing the zone of maximum temperature. Both actions tend to form the clinker low down in the fire. Economy of fuel results directly from the low fire zone, because the upper surface of the fire is cooled down to such a point that excess of CO is not formed by the air blast. The number of down-runs is, therefore, limited by the amount of CO required to heat the carburetter. It is well to note too that fuel economy is also secured in the same way by high blasting rate.

The purposes of the air blast in the generator are the recuperation of the fire and the production of CO to be used in heating the carburetter. Economy in fuel requires that the quantity of air used shall be the least possible to attain these two ends. If a given quantity of air be passed through the fire at low velocity, a large proportion of the resulting gases will be CO and the recuperation of the fire will be correspondingly reduced. On the other hand, the same quantity of air can be blown through the fire so rapidly, that very little CO can be formed and a correspondingly high fire temperature produced. It is apparent then that, in the proportion of down-runs and the rate of blasting, we have two means of regulation of fire and heats, the correct balance of which leads to the greatest economy.

The proportion of down-runs to be used depends largely upon the character of the fuel and local conditions. For an average grade of anthracite coal, 60 per cent. of down-runs can be used to advantage, except at the beginning and ending of the shift, when the proportion may be reduced to from 40 per cent. to 50 per cent. With a large proportion of down-runs, it must be remembered that the quantity of CO formed at the beginning of the blow is small and requires but a small amount of carburetter blast at first, and increase in the latter as the blow proceeds. As the regulation of the fuel bed determines, in large part, the quantity of gas made and the generation of CO to heat the carburetter, the importance of maintaining proper conditions of fuel bed is apparent. Combined with the judicious use of down-runs, if we can deliver the same quantity of air at the same velocity each blow, we have eliminated a set of variables which affect capacity, quality and economy in both fuel and oil.

From a large number of experiments it has been found that, as a general figure for anthracite coal and 22 to 24-candle power gas, good fuel results are likely to be secured with the use of about 1,400 cubic feet of air per 1,000 feet of gas made. Experiments thus far show that an economical rate of using this air lies between 95 and 105 cubic feet per minute per square foot of grate surface. At a lower rate a larger quantity of air will be required and loss of CO at the stack valve is likely to result. These figures refer to an active depth of fuel bed of from 6 to 7 feet. A deeper fuel bed will produce more CO in the blasting gases and but little difference in quantity of gas made per run.

These considerations indicate briefly the value of a meter of some sort to determine the quantity of air used. Not only does the air meter enable us to continue a uniform condition of blast once determined for a given set of conditions, but in changing from one set of known conditions to another it enables us to repeat any previous cycle very perfectly. By measuring the air supplied to the generator we are enabled to eliminate the uncertainty of the resistance of the fire and to supply the same quantity of air per 1,000 feet of gas made at the end of a day's run as at the beginning, although it will probably require 7 or 8 inches more generator blast pressure to do this. We can also deliver the required quantity of air at the rate most economical in point of restoring the heat to the fuel bed, and in furnishing only sufficient CO to maintain carburetter and superheater temperatures. We can also readily compensate for varying conditions of moisture in the fuel and for atmospheric changes.

Turning now to steam meters, we observe that they provide a simple and accurate means of delivering the required quantity of steam without variation to the generator under all conditions, and to instantly change from one rate to another. In determining upon a set of new conditions this ability to deliver any desired quantity of steam without recalibration or adjustment is of great value. The meters also

enable us to proportion readily the quantity of steam on up and down-runs to secure uniform make on both runs and favorable conditions of fire. What these variations are is largely a matter of experiment, depending upon the character of fuel and quality of gas required. Ordinarily more steam is required at the base of the generator than at the top, on account of the condensation in the ash pit, etc. As a general figure, it has been found that 34 pounds of base steam and 27 pounds of top steam per 1,000 feet of carburetted gas made are about average requirements in the case of ordinary anthracite coal and gas of 24-candle power. With these steam rates, and under the conditions heretofore noted, we should expect a make of about 56 cubic feet of gas per square foot of grate surface per minute with a total make per run of about 280 cubic feet per square foot of grate. A concrete example will conveniently illustrate the use and operation of the meters, and to that end let us assume the the use of anthracite coal and the production of 24-candle power gas.

To summarize, let us assume that we are to start an 8-foot 6-inch set under the conditions above stated. We should expect satisfactory results on the following basis:

Inside diameter of generator	6 feet 6 inches.
Area of grate surface	33.2 square feet.
Depth of active fuel bed	6 feet.
Desired make per sq. ft. of grate surface per min. of run	56 cubic feet.
" " " " " run	280 "
Length of run, nominal	5 minutes.
" " actual	4.8 "
Base steam per 1,000 feet of gas made	34 pounds.
Top " " " "	27 "
Air to generator per 1,000 feet of gas	1,400 cubic feet.
Velocity of air per sq. ft. of grate per minute, say	99 "

Applying these figures to the 8-foot 6-inch set, we have:

Make per minute of run = 56 × 33.2 = 1,859.2 cubic feet.
" run = 1,859.2 × 4.8 = 8,920 cubic feet.
Base steam = 1.859 × 34 = 63.2 pounds per minute.
Top " = 1.859 × 27 = 50.2 " "
Air per blow = 8.92 × 1,400 = 12,488 cubic feet.
" square foot of grate per blow = 12,488 ÷ 33.2 = 376.1 cu. ft.
Length of blow = 376.1 ÷ 99 = 3.8 minutes, actual.
" " = 4 minutes, nominal.
Air per minute of blow = 12,488 ÷ 3.8 = 3,286 cubic feet.

The above assumption formed the basis of a test run of 5 days' duration. As the test proceeded it was found desirable to change the quantity of steam and the proportion of down-runs to meet the actual conditions. The following table, showing the methods of operation on the last day of the test, has been followed quite uniformly since:

Average make per run	8.98 1,000 cu. ft.
Make per set, 24 hrs., include time of 2 cleanings	1,226 1,000 "
Base steam, assuming same make up and down	32.07 lb. per 1,000
Top " " " " "	26.7 "
Average steam per 1,000	28.8 "
Average number of down runs, 24 hours	61 per cent.
Air per 1,000	1,365 cubic feet.
Length of run (actual 4.8 minutes)	5 minutes.
" blow (" 3.8 ")	4 "
Gross coal per 1,000	30.5 pounds.
Oil per 1,000	3.98 gallons.
Candle power of gas	23.66
" per gallon	5.94

These results are very nearly an average for the 5 days' test. The whole test was carefully made and on one set running continuously. In order to compare the test results with ordinary operating conditions, I append a table showing average results made with the same size sets, but with many broken runs during the month of December, 1908. It will be noticed that much higher oil was required and it was necessary to shift back and forth from coal to coke during the period covered.

	Coke.	Coal.
Make per run	6,470 cu. ft.	8,844 cu. ft.
" minutes of run	1,703 "	1,842 "
" sq. ft. of grate per minute of run.	51.3 "	55.5 "
Base steam per minute	60 lbs.	60 lbs.
Top " "	48 "	50 "
Ave. base steam per 1,000, assuming equal make up and down	35.23 lbs.	32.57 lbs.
Ave. top steam per 1,000, assuming equal make up and down	28.19 "	27.14 "
Oil per 1,000	4.64 gals.	4.49 gals.
Candle power per gas	5.71	5.74
Average fuel per 1,000	31.93 lbs.	31.93 lbs.
Air per 1,000	1,407 cu. ft.	1,396 cu. ft.

This fuel figure is the average for both coke and coal, because in shifting back and forth between coke and coal there were partial runs using both kinds of fuel, and for that reason I have to give you the average figure, which accounts for the same figures being reported in each case, although there is really very little difference.

The average fuel results obtained in regular operation for the 3 months succeeding the introduction of the steam and air meters are 31.76 pounds of gross fuel delivered to the water gas plant per 1,000 feet of gas made. This is a saving of 4.11 pounds of fuel over the average for the 3 months preceding the use of the meters, the fuel in each case being anthracite coal and coke in varying proportions. In addition to the fuel saving we have increased the make per set about 20 per cent. on both coal and coke. In considering the fuel results given it is but fair to say that they are obtained from the use of only two 8-foot 6-inch sets in use at a time and with but one set in operation about half the time.

The manufacture of water gas is a chemical process involving the use of definite quantities of all the substances employed. Many of the reactions are but little understood, and many of the constituents are so complex as to make exact and full analysis impracticable. Considering the real delicacy of the process, and the number of details involved, the wonder is that with the hit-or-miss methods quite commonly employed, we get so good results.

The use of steam and air meters is a natural development of the process, and by their use we are on the way to more accurate information and better results. On the other hand, it does not follow that the simple introduction of these meters will, in itself, guarantee any improvement. To the ordinary gas maker they are of little assistance except as he is instructed to follow a scheme laid out for him. The chances are that he would be unable to use them intelligently in meeting a change in conditions requiring a new schedule.

Discussion.

The President—Gentlemen, we have listened to a very interesting and instructive paper. We shall be glad to have any of you discuss this paper or ask Mr. Wyant questions. Have any other members air and steam meters in use?

Mr. Kennedy—I have not had much time to look at this paper, but I did want to know whether the conditions of testing and of the gas, as regards the temperature, had been at all changed since the introduction of this apparatus; in other words, had the contractors who put in this plant gotten busy and remodelled the whole thing from start to finish? I want to know whether the coke used here is high grade, or whether it is of the West Virginia coal type. It seems to me that the original figures must have been nearly 36 pounds gross of fuel (which I take it included moisture) prior to the introduction of this apparatus. If that were the fact prior to the introduction of the apparatus, and it was practically 32 pounds after the introduction of the apparatus, it is such a big saving that I want to know whether that was due to the steam and air meter apparatus or to the change in fuel, operating, etc. In other words, it is a very easy proposition to get 3 pounds of fuel difference by changing your coke, and you can very easily get it by taking the best coke and the West Virginia coal coke. The high candles per gallon per 1,000 that are gotten here, to my mind, don't mean very much unless I know what went on before, whether they are now using a No. 2 Metropolitan Argand burner, which gives 1½ candles on the same gas over the standard Massachusetts burner, and whether the gas, in accordance with what I will call the U. G. I. practice, is run hot into the photometer. There is, of course, a very great reason for running it hot right up to the point of mixture. With coal gas (if you are using the mixture) the result shown on the photometer is in a measure not a criterion of the actual working of the plant, but measurably a faked figure. Many of those points which occur to one might be cleared up if we knew something about how the plant was operated before. It seems to me that the blows and the runs have been shortened, and it seems to me that under those conditions and high blast you are going to get a much finer figure with coal than you are with coke naturally, because of the amount of dust and breeze sent over under a high blast; the pressure is not recorded. Under a high blast, in using coal you are practically free of that, but in using coke I have found that such an enormous quantity of fine coke goes over in the carburetter that it is a very difficult thing to maintain a condition which enables the gas maker to go on as perfectly with the plant after you have left it over night. I want to know, referring to the last part of Mr. Wyant's paper, whether he felt that he ought by necessity to add that or leave it out. In other words, isn't there a lot of trouble mixed up in this steam and air meter business? I like the idea, but I think it brings the gas works superintendent and chemist, and the balance of the

men who have the least time to operate down on the job, and the gas maker sits down.

The President—Are there any other questions that any of the members would like to ask Mr. Wyant?

Mr. Cheney—How much fuel is recovered from the cleanings, and what is done with it?

Mr. Nute—As long as questions are in order I would like to ask whether these figures of coal and coke are actual weights, as I think they are, without allowing for any discrepancy. I think we have all had the experience that when at the end of a year we figure up the coal pile, no matter how careful we have been, we are always short.

Mr. Miller—How does Mr. Wyant alter the pressure of the blast? If he will answer me now then I will go ahead.

Mr. Wyant—We simply alter the pressure of the blast by raising the blast valve, but the point is that we want to deliver the same quantity of air. If the resistance is lower in the generator it requires less blast pressure and, therefore, less opening of the blast cocks.

Mr. Miller—Just an ordinary Sturtevant blower?

Mr. Wyant—Yes.

Mr. Miller—Then what I want to say about that, if he carries a blast that is so much higher than is necessary under the grate the boiler fuel would be higher, and I would like to know what the boiler fuel results are, because the extra amount used may more than compensate for the saving in the generator fuel.

Mr. Z. M. Jenks—I would like to ask the gentleman, with reference to the amount of steam, how he tapered that down. I see he tapers down on the amount of blast. I assume he ran those sets 12 hours without cleaning, and I would like to inquire if, during the last few hours of the run, he did not taper down on his steam, and how much?

The President—Any other questions? If not, we will give Mr. Wyant an opportunity to answer the questions.

Mr. Wyant—Answering Mr. Kennedy's question, the conditions of fuel have not been changed in the least since the introduction of the meters. We are using about the same proportion of coal and coke, exactly the same coal; also coke made from the same coal—Westmoreland. On a dry basis an average of several analyses gives volatile combustible, 3.15 per cent.; fixed carbon, 86.40; ash, 10.45. For the anthracite coal, I have here two sets of analyses. The first give moisture, 3.29; volatile combustible, 5.74; fixed carbon, 79.91; ash, 11.06. The second gives moisture, 3.53; volatile combustible, 5.30; fixed carbon, 81.57; ash, 9.5. There is no change in the coal, neither is there any change in the coke. I might add, in regard to the weight of the coke and the manner of measuring it into the water gas plant, that coke is not weighed into the plant, but it is carefully measured, the weight per bushel being arbitrarily assumed at 36 pounds. We find this weight is almost the identical figure, allowing for the moisture, with the anthracite coal used. The coke averages in weight 40 pounds per bushel as it comes to the water gas plant, and contains an average of about 12 per cent. moisture. Figuring back to a 3 per cent. moisture basis, agreeing with the anthracite coal, would make the weight figure about 36¼ pounds. So that we arbitrarily assume a weight on the coke. That same method was in use before the introduction of the meters, and all the figures in the paper are based upon that method. There have been no changes made in the water gas apparatus since installing the meters, excepting what are necessary in the piping to install the meters. We have in one case used a little larger space in checkering the carburetter, and in some sets we have not. I have not fully made up my mind whether the change was a good one or a bad one, but I am inclined to think I shall reduce the spacing of the carburetter bricks on the next checkering. With regard to the burner, we use in the photometer for the water gas a common 7-foot lava tip, and the gas in passing through the photometer is the finished gas from the outlet of the station meter. As to the last statement, my purpose in making it I think I made pretty plain in the statement itself. The meters will not guarantee better improvements unless they are intelligently used. They are instruments which give us the opportunity of knowing far better what we are doing, and the average water gas maker has not the intelligence to interpret the results obtained and to make changes in his operation based upon the quantities of the materials used. With regard to the second question, as to the quantity of coal gotten from the cleanings, I can't say exactly what that amount is; but it does not vary very much from day-to-day. For that reason it is simply taken out of the bottom, goes in at the top and forms a cycle. It is coal that must be lost in cleaning the fire, which coal is put back in the generator the following day, and on the next cleaning it is taken out again. It is about the same quantity, and we don't make any note of it. In regard to the coal and coke I have already spoken. There is no connection in our plant between the high boiler pressure and the blast pressure, because the same set of boilers is serving the whole of the works, and the blowers are motor driven from an electric plant. As to the use of steam at the end of the run, we don't make any change during the day. The quantity used is the same at the end of the day as at the beginning, and we have until the end of the run practically the same depth of fuel, because, as the ash and clinker form in the bottom, we keep raising up the top of the fuel bed in order to maintain a practically constant depth of fuel bed during the entire run. The manner of operating the steam valves and determining the quantity used is simply by opening the valve more or less and reading from the gauges the quantity of steam passing. The gauge is a steam gauge, calibrated to read directly in pounds of steam per minute, so that in operation it is only necessary to open the steam valve to such a point that the indicator on the gauge points to the number of pounds of steam you propose to use.

Mr. Miller I hardly think Mr. Wyant answered my question. If his differential pressure varies by 6 or 8 inches, which I think he mentioned, then he must carry at the beginning, when the fires are first cleaned, 6 or 8 inches more blast pressure than is actually needed in the generator, provided the speed of the engine is not changed between cleanings. Now, what is the difference in the consumption of boiler fuel with and without the air meter? That is what I mean. I did not refer to the steam pressure, but to the consumption of boiler fuel.

Mr. Wyant—I cannot give you that figure, because, as I said before, one set of boilers serves the entire works. However, the power used in producing this blast is probably not very different from that used before the introduction of the meters. In one case it was a guess as to how much blast we needed, and at times we undoubtedly used more, at other times less. I might say that, during the installation of the meters, we had two sets running side-by-side, one set being equipped with the gauges, the other set being equipped with the meters, but without any gauges, and although we were running these two sets under the same cycle and under as nearly the same conditions as we could, by opening the steam valve the same amount and raising the blast gates the same amount for pretty nearly the entire day, we had more or less blue gas escaping from the stack valve during the blow on the sets that did not have any meters.

Mr. Klumpp—After considerable experience with Sturtevant centrifugal blowers, I found that the power absorbed depended very nearly upon the demand made upon the blower for air. The quantity of air delivered depends upon the valve opening at the blower outlet. With a closed valve at the blower outlet, the power necessary to carry a few inches higher pressure is only that power necessary to turn the blower at that increased speed, as no air is delivered. So under these conditions, with the valve closed, it required but very little more power to drive the blower at 30 inches than it does at 24 inches pressure. So, then, under these conditions it does not require so very much more power to deliver the air at say 24 inches, when the blower is holding it 30 inches on the outlet, than it does to deliver the same amount of air at 24 inches when the blower is operating to give 24 inches pressure; only that power necessary to turn the blower at this higher speed.

Mr. Ramsburg—I think the reading of a paper of this kind, with a showing of a saving of 4.11 pounds of generator fuel per 1,000, comes as a shock to a great many water gas operators. They are naturally skeptical of a claim that, by placing air and steam meters on their sets, there would result any such saving. Upon consideration of how such a saving may be effected and what points are lacking in our present methods, I think will be more receptive. I am not conversant with New England practice, but I judge that the methods are the same here as any place else; namely, that one of two methods of blasting is used—to run with a constant blast head under the grate or with a constant differential through the fire; both are fallacious and wrong in principle. In the first method, by putting the same pressure under the grate after cleaning, as is proposed to be used throughout the run, the maximum amount of air passes through the fire, causing an excessive fire temperature and a consequent large amount of make and a low acid. From this time until the next cleaning of the fire, there will be a constantly decreasing amount of gas being made; a constantly decreasing amount of heat in the fire; a constantly increasing amount of carbonic acid in the blue gas; a constantly increasing amount of excess and, therefore, wasted steam. With the excessive fire temperature at the beginning of the cycle after clinker, there will be a large amount of CO escaping unburned from

the superheater stack. Each 2 per cent. of CO wasted in this manner means the loss of 2 pounds of generator fuel per 1,000, and each per cent. of CO_2 in excess in the finished gas, which would occur as the cycle progresses, will mean a loss in oil efficiency of more than 4 per cent. In contrast to this we have the means of putting through this machine an unvarying amount of air during the whole cycle, previously determined as the proper proportion, so that in conjunction with constant steam supply and constant methods of operation these losses can be avoided. The blast meter has no mechanism consisting, as it does, of simply a short pipe with a restricted throat, on the Venturi principle. Upon determining the required amount of air to be run, and so instructing the gas maker, one is reasonably sure that, from clinker to clinker, the apparatus, with a constant predetermined amount of steam, will produce a constant amount of gas, and that this can be made without an excess of CO escaping through the stack to increase the generator fuel, or without an excess of carbonic acid in the finished gas to lower the oil efficiency. For the oil efficiency to be kept up to a high point two things are important, low carbonic acid and constant operating conditions. The blast meter and the steam meter bring the matter much closer to the theoretical. Mr. Wyant has not mentioned in his paper the ability to lower the carbonic acid, but I am confident that the good oil efficiency shown is partially due to the low percentage of this candle power lowering element. The steam and air meters are especially useful in operating sets with coke fires. This material having a great tendency to clinker, it is expected that much less gas can be produced on coke than coal. By a proper proportioning of the air and steam, with a careful regulation of the length of blow and run, the formation of clinker can be minimized, and it is possible to make more gas on coke with these devices than was formerly possible on coal with old methods. I am anxious to know whether my statement, in regard to the make of gas from clinker to clinker, being a constantly decreasing quantity, is correct, and will ask whether in the observation of any of the gentlemen present, who are operating one single machine, this had been noted? To summarize what I have tried to bring out, Mr. Wyant is able to show such a large saving in generator fuel, because the conditions of operation in water gas plants throughout the country, make it necessary to have large wastes, which can be overcome by introducing more exact and unvarying conditions.

The President—Mr. Ramsburg has had a great deal of experience with air meters. If any gentleman would like to ask him questions he will be glad to answer them. Mr. Morrison, can you give us any figures in regard to the decrease in the amount of gas made from the beginning to the end of the day?

Mr. Morrison—I can't give any very definite figures. I think Mr. Ramsburg has brought out the fact that, under the old way of running, there is a constant decrease of gas made per hour or per minute throughout the cycle, while with the air and steam meters on it is certainly possible and practical to get a practically constant make. I don't think it needs very much argument to convince any of us that uniform conditions should produce uniform results, and should not only produce uniform results but uniformly better results, simply because of more uniform conditions. The paper brings out very nicely the variables which may be eliminated by the use of these meters. I agree with his conclusion that the steam meter and air meter given to an average maker, with no set scheme laid down for him to follow, will produce just what he says, and no result whatever, but with a scheme laid out as Mr. Wyant's is laid out, and followed as his is laid out, it would seem as if more uniform results and better results must follow.

Mr. Kennedy—If I may interrupt, I don't want to go on record as disbelieving in the efficiency of such an apparatus. My sole point was to bring out, first of all, the possibility of a deception and error; secondarily, which is to my mind the essential thing at the present stage, what is the degree of change made from the old conditions. Mr. Morrison said what Mr. Wyant says in the last lines of his paper, that it needs a scheme. Now, what I want to know is, how frequently must you re-scheme it?

The President—I will ask Mr. Ramsburg to answer that question.

Mr. Ramsburg—The variables which would cause you to reset the scheme, or rather, make a readjustment of the conditions, would be that made necessary from time to time during the year as it becomes necessary to change the candle power to be made and the changes made necessary by the introduction of a new grade of fuel. For example, if Mr. Wyant were to change from Westmoreland coke to West Virginia coke, the change in the fusing point of the ash of this new fuel would make it essential to keep the zone of high temperature at a lower heat, and he would have to reproportion his up-and-down runs. The general scheme requires few changes, and I firmly believe that, put into the hands of any ordinary-brained gas maker, with the instructions which would ordinarily go with such an apparatus, the results would show an improvement over those without it. With care and watchfulness on the part of the superintendent, with the exercise of some judgment and deduction, they would show extensive savings. I think the reduction of the carbonic acid in the finished gas a very important point, so important in fact as to warrant my calling attention to it once more. When you return to your plants take analyses of your finished gas shortly after clinkering and immediately before; note the difference, and remember that candle power per gallon falls off 24 points for each per cent. of carbonic acid in the finished gas. Another thing that a constant blast supply during the entire clinkering period effects is a reduction in the amount of clinker and the time wasted in renewal. It is not necessary for me to go into this as to the reason, except to say that the excessive blast, used on machines immediately after clinkering, is largely responsible for a great deal of clinkering troubles. The two great prime movers in the world are oxygen and carbon. The carbon is of no value without the oxygen and the oxygen is of practically no value without the carbon. You have in your generator fire an excess of carbon. The one thing required is oxygen to make energy. Should you admit this oxygen in varying quantities, you will get varying quantities of gas; whereas, if you admit the oxygen at a constant rate, you will get constant energy and in this case constant gas production. Importance of keeping down the carbonic oxide in the escaping blast gases is scarcely possible of overestimating. As I have said 2 per cent is equal to a pound of fuel. This can be estimated roughly with little difficulty by analyzing the blast gases for carbonic acid. Should there be no excess of oxygen the amount of carbonic acid in per cent. subtracted from 20 per cent. and doubled, will equal the carbonic oxide present, roughly. If you wish to find out, therefore, how much fuel is being wasted in your plant, simply do this and you will see where the measurement of air and steam becomes an effective item for economy.

Mr. Charles F. Leonard—What does Mr. Ramsburg consider the right percentage of CO_2, and what can be obtained with this scheme.

Mr. Ramsburg—With good anthracite coal, I think from 2.27 to 2.6 per cent., with coke of fair grade from 3.4 to 4.2 per cent., with our present apparatus it is impossible to get below these figures with economy of fuel. It may be with new devices to keep our fires in better shape than 2 per cent. acid in coal and coke may be a development.

Mr. Jenks—That carbonic acid feature was just the point of my question with reference to the tapering off, where a man has it in his hands so to do, of the amount of steam sent to the generator fire. It seems to me this whole general subject is a very interesting one to the water gas maker. If with a clean fire the production of gas is a certain quantity per run and per hour, and that fire is not cleaned for 12, and in some instances for 24, it is very apparent to me, when it comes time to clean, the amount of carbonic acid present must be considerably in excess of what it was at the start. I would like to ask the writer of this paper if, during this series of experiments, they took off samples of the gas from the machine and tested it, either for carbonic acid or for its candle power. It seems to me these experiments are in the right direction, and it is no use for this Association to shy at it, because I am of the opinion that we have been operating our water gas sets by the rule-of-thumb for a great many years. We very carefully measure the oil that must go in, to a gallon exactly right, but when it comes to the measurement of the amount of air going into the set, and the amount of steam going into the set, the whole thing is an open question.

Mr. Wyant—Tests were made throughout the run for both carbonic acid and candle power, at very frequent and definite intervals, and throughout the run the variations in CO_2 were within 1 per cent. I am sorry I have not those figures here; but the average for the day was between 3 and 4 per cent. of CO_2, and with a variation inside of 1 per cent. from the beginning of the run to its end.

Mr. Leonard—The test gives the coal consumption as 30½ pounds, and under everyday operation as 31.93 pounds. I would like to inquire, using anthracite coal, what could be expected as the last word that the people who are putting out this apparatus would give as coal figures. What could be expected for year round work with anthracite coal, including coal pile discrepancies?

The President—Mr. Ramsburg, have you any figures you can give us?

Mr. Ramsburg—From a theoretical standpoint, the production of a 24-candle power would involve the expenditure, with the losses ordinarily regarded as necessary, of 26 pounds of carbon. To express generator fuel results in pounds of coal or coke is, of course, wrong for purposes of comparison. What we should do would be to express it in pounds of carbon per 1,000. Ordinary commercial anthracite runs from 79 to 83 per cent. of fixed carbon, charged with about 4 or 5 per cent. of volatile combustible, so that the best result possible would be about 29 to 30 pounds of such a coal.

Mr. Morrison—Mr. Wyant, assuming a certain set of conditions, figures his make per run as 8,920 feet. In actual conditions, under test, his make is 8,980 cubic feet. To only one thing can you attribute that agreement, and that is the use of the air and steam meter. Where you figure what you want, and with your air and steam meter can get it, I call that uniform work, and it is that which is going to give you uniformly good results.

Mr. Jenks—It would be interesting to know what heats Mr. Wyant carried during all these experiments. What were the temperatures?

Mr. Wyant—The heat at what point?

Mr. Jenks—Carburetter, etc.

Mr. Wyant—I cannot tell you at the carburetter. We have carried about 1,400°, at the top of the superheater between 1,300° and 1,400°

Mr. Jenks—A little higher at the carburetter?

Mr. Wyant—Higher in the carburetter; yes.

Mr. Leonard—I would like to ask if there is a notable increase in the efficiency of oil by the use of this apparatus?

The President—Mr. Wyant, can you explain the increase in candles per gallon? Is that what you mean, Mr. Leonard?

Mr. Leonard—I have not noted that there is an increase in the oil efficiency. I would like to know whether there is any over the ordinary operation.

Mr. Wyant—Our oil figures have not materially changed since making the change in the meters.

Mr. Slade—I would like to know whether Mr. Wyant uses a pyrometer continuously?

Mr. Wyant—We don't all the time; but I am going to.

Mr. Cheney—I did not understand Mr. Wyant to say whether he had changed the time of running, that is, the length of runs and blows, since he has made this change, and if he has, I would like to know what determined that length?

Mr. Wyant—We have changed the length of runs and blows, and are now working on shorter cycles than we did previously. That matter also affects, of course, the CO_2 produced. As you note from the paper, the cycles are quite short, 4 and 5 minutes on coal and 3 and 4 minutes on coke. The reason, of course, is to maintain the fire in as nearly a uniform condition as possible, and to stop the run before you get a large quantity of CO_2.

The President—Have any of the gentlemen figures on the increase in the oil efficiency? Mr. Ramsburg, have you any figures with you?

Mr. Ramsburg—I think that, with this method of operation, you can safely count on lowering the carbonic acid in finished gas 1 per cent., under which conditions there will be an increase in the oil efficiency of 4 per cent. In addition to that, I think you get an increase in oil efficiency due to the fact that we have a regular flow and a regular supply of heat to the carburetter. It is not possible for me to give any figures on oil results, because we have had a method in operation in the Philadelphia gas works somewhat similar to this for so long a time (this blast meter being a development) that it is impossible for me to say how much the blast meter has improved the results of blasting on plants under my personal observation. I think an improvement in oil results of 5 per cent. over good present practice might be expected with justification.

The President—How many candle power per gallon would you expect with the apparatus running properly?

Mr. Ramsburg—I think, with the apparatus running properly, with good gas oil, gas read, after being subjected to a preliminary cooling of 70° F., candle power of about 24, read on a flat flame burner of reasonable efficiency, each hour of the test, by a competent reader, against a pentane lamp, that 5.70 to 5.80-candle power per gallon, corrected to 60° and 30° barometer, might be expected. While I am on my feet I will read some figures which I think will be of interest in connection with the paper. These were made by Mr. John Rusby. They show an accounting for 28.97 pounds of carbon charged into a generator per 1,000 feet of gas and what is the final disposition of this material:

1. Latent heat of combustion energy delivered in blue gas	14.15
2. Sensible heat of escaping illuminating gas at superheater stack	2.40
3. Sensible heat of escaping blast gas at superheater stack	5.03
4. Radiation and convection losses	1.36
5. Latent heat of evaporation and gasification of oil	0.90
6. Sensible heat in ash and unburned coal from generator	0.20
7. Sensible heat in excess steam	0.62
8. Latent heat of combustion of 4 per cent. CO., assumed to be wasted at the superheater stack; this is not necessary	2.08
9. Carbon from bottom of generator	1.40
10. Carbon in ash to dump	0.83
	28.97

I read this because I think it is of great interest to see that there is over 7 pounds of fuel per 1,000 escaping from the generator stack as sensible heat. Not only that, but it only requires .9 pound of carbon to keep the carburetter and superheater up; in other words, that is all the heat that is taken up in the gasification of oil. I think that that is rather a startling statement, but it has been worked out very carefully, and it calculates out that only about 1 pound of coal goes to supply heat for gasifying the oil.

The President—I understand they have some of these meters in use at Malden and are getting very good results. Mr. Prichard, can you say anything on this subject?

Mr. Prichard—I think we are all willing to agree that the closer we can operate our works and adjust them exactly the better results we can get. One thought that came into my mind as the discussion progressed was, how dependable are the meters? If we are establishing a system of running by meters, and after we have been running a couple of days the meters go wrong, we are much worse off than if we had stuck to our old methods. I am assuming that these meters do not require standardization very often, that they run for long periods very accurately; but I should be glad to have that matter on record. Also, I am assuming that the results Mr. Wyant gives are corrected by temperature.

Mr. Wyant—Yes, sir.

Mr. Prichard—It appears to my mind, now that it has been whittled down to a point where the saving to be effected is something like 4 pounds of fuel per 1,000 of gas, and 4 per cent. on the oil results, so that anyone can translate that into money very readily, amounting to about 1¼ cents.

Mr. Miller—I think that some of us have been using the steam meter for a good many years, and all these results are with both the steam and air meter. Could anybody give us any fuel results for the two separately, in order that we may know what improvement is due to the air meter alone?

The President—Will any one answer Mr. Miller's question?

Mr. Leonard—Mr. President, I will give results without either. Last year, for the fiscal year, the results at Fall River, including all discrepancies in the coal pile, were 31½ pounds of anthracite coal.

Mr. Miller—Thanks Mr. Leonard, but I think all of us can give plenty of results without either, but I would like to have comparative results on the same machine with the two meters separately, and then with both together, and see where the difference lies, so we would know whether the investment is worth while.

Mr. Kennedy—Mr. Wyant brought out a point which I hate to talk so much about, but in which I am interested. He had decreased his blast period and his periods of steaming, etc. If that is the case, in conjunction with the fact that his candle efficiency has slightly decreased, if I remember conditions correctly, is it not possible that a part of his fuel saving is not attributable at all—and this is what raised the doubt in my mind—to the air and steam meter, but essentially to the fact that he has gone on to a shorter blow and a shorter run and a higher blast. It is a well known fact that if you increase your blast and blow your fire to CO_2 you can save fuel, and I want to know why Mr. Wyant opened out his checkers, whether he did not do that because he found under his different blowing conditions he had ignition troubles in the carburetter, whether he did not find that the ignition was taking place too far down in the carburetter. The second point I want to know is whether he started out with a perfectly clean, newly checkered apparatus, and in what condition the apparatus is to-day, with the amount of fine coke that is blown over with a high blast and short blow.

Mr. Wyant—It is undoubtedly true that part of the improvement is due to the change in operation as to the cycles, just what part I cannot say; but from what I said a few moments ago, about the comparison of two sets side by side, one with meters and the other without, I don't like to be without the meters. With regard to the change

in the checkering, the spaces were widened out from 2½ to 3 inches, in order to reduce the resistance through the carburetter. The 3-inch spacing I think is too large, and I have reduced that spacing in the last checkering of a set to 2¾. The test was made on a set that was newly checkered, but the sets are rechecked after 100 days' use, and are not allowed to run under bad conditions in any case. The last results given in the paper, for December, were taken on the same set, I believe, that the test was made on.

Mr. Parker—I would like to ask if there is any difference in the amount of tar produced by his method of running over the old method?

The President—Any other question on this subject? It is quite an important subject. There is no question but that in running a water gas apparatus we may get the theoretical results without any appliances. With the air and steam meters we measure our air and the steam, and we can get those results quicker and more uniformly. It is in the right line of reasoning and ought to work out right. Anything further?

Mr. Gardiner—I would like to ask whether the air and steam meters are or can be so devised that we can take a record from them automatically. It is a good thing to give a man good tools; it is a better thing to know how he uses them.

Mr. Ramsburg—There is no doubt but that such a device is entirely feasible and a logical development. We have at the present time in operation an experimental, recording, differential pressure gauge, which seems an entire success. This could be used for this purpose with a proper chart. For a recording steam meter, it would be only necessary to put a recording steam gauge in place, and the present steam meter gauge with proper charts.

On motion of Mr. Anderson the thanks of the Association were tendered to Mr. Wyant for his very valuable and interesting paper.

(To be Continued.)

[Concluded from page 541.]

SECOND ANNUAL CONVENTION, INDIANA GAS ASSOCIATION.

HELD AT CLAYPOOL HOTEL, INDIANAPOLIS, IND., JAN. 20TH AND 21ST, 1909.

SECOND DAY—AFTERNOON SESSION.

The President—The proceedings for the day will be commenced by Mr. E. A. Wakeman, of Terre Haute, Ind., who will read his paper entitled,

METERS AND METER READING.

It is not my intention in this paper to go into a long string of details in reference to meters and meter reading, but to call to your attention a few points which are often neglected and which, if remedied, would to a certain extent overcome much of the feeling which exists against the gas company.

The connecting link between the company and the customer is the gas meter. Its function is to register the amount of gas that the consumer uses. This being the case, it is of vital importance that this measuring instrument should be kept in perfect condition. In order that this may be done, we must give careful attention to the inspecting and repairing of meters. It is conceded that the larger companies are better equipped for making such inspection and repairs than the smaller ones; and it is on the minds of the managers of the smaller companies that I would like to impress the absolute necessity of giving their meters a general overhauling at least once in 4 years.

This has been very forcibly brought to my attention by the condition of some of the meters that have been sent for repairs to the meter factory which is located in my city. A large per cent. of meters sent to this factory for repairs on test show that they are slow from 10 per cent. to 30 per cent., and 8 per cent. to 10 per cent. show no register at all.

I have examined a number of meters where the cases appeared to be in good condition, but on opening the meter found that the partitions had a number of pin holes, the flag arms and valve stems were nearly all eaten away, and the diaphragms so badly dried up that, on taking hold of them, they fell to pieces. It is very evident that, when meters are allowed to get in this condition, they will not register all of the gas that passes through them. If we allow our meters to get in the condition above mentioned, are we not doing all that we can to create suspicion in the minds of our patrons that meters are unreliable?

I believe most of us have had called to our attention the great difference in the gas bills of people using gas under practically the same conditions. One may have a bill averaging $1 to $2 a month more than a neighbor, which can only be accounted for by the fact that one of them is paying for all the gas he uses, the other one being fortunate in having a meter that may be from 15 per cent. to 30 per cent. slow. The one paying the large bill is by no means satisfied that his meter is correct, and there is no argument which we can use that will convince him but what he is paying for more gas than he uses.

Not long ago there were received at the factory in Terre Haute, 50 meters for repairs. Out of the 50, 27 averaged 17 per cent. slow, 18 tested correct, and 5 were 3 per cent. fast. Either the gas sent through these meters was not properly purified, or the meters had been in service for a number of years, for most of them seemed to be in a very bad condition. Estimating the sales on these meters the same as the sales per meter at Terre Haute, which is 37,000 cubic feet per year; 17 per cent. of 37,000 cubic feet or 6,290 feet of unaccounted-for gas, at $1 per 1,000, would show that the company owning these meters was losing money at the rate of $6.29 per year on each of the 27 meters.

The length of time a meter should be left in service before taking in for repairs depends entirely on the amount of gas passed through it and the impurities that are in the gas. I have seen the working parts of new meters nearly destroyed after being in service for only 1 year, no doubt caused by not giving proper attention to purifying the gas. I believe that if we would pay more attention to keeping our meters in good working condition it would not only increase our net earnings, but at the same time it would go a long way towards creating a better feeling between the company we represent and the consumer.

One thing further to which I would call your attention is to eliminate mistakes in reading meters as far as possible. My experience is that a careless meter reader will cause the company any amount of trouble. If a meter should be under-read we are not apt to hear much about it until the next reading is taken; it is then that the trouble begins. We can do our best to explain that the meter was probably under-read the previous month, which accounted for the current bill being so much larger, and while there may be some who will understand the explanation, there are others who, if they do understand, will pretend they do not, and are under the impression that the company is taking advantage of them, or that something is wrong with the meter.

The plan we have adopted for the past few months, and which has been fairly successful in eliminating mistakes in reading meters, is to offer a premium to the men who make the least mistakes. This premium we give in money every 6 months, and it varies from $2 to $10. It is carried on as follows: If we receive a complaint as to the amount of the bill rendered, a man is sent to take a second reading of the meter other than the first reader; if the meter is found to have been read incorrectly, that is one mark against the man who read the meter first. All of our readers seem to take an interest in winning this premium, and mistakes in meter reading since this scheme was introduced have been very few.

We instruct our men to teach the people to read their own meters, as we believe the more people who are taught to read their meters the less complaints we will have, for they from time to time can check their meters; thus, when the bills are sent out, they are not so apt to find fault as they are where they know nothing about reading a meter.

We have in plain sight in our office a card about 2 feet square, on which is printed the figures that are shown on the dial of a meter. On top of this card is printed, "Learn to read your own meter." The clerk will show anyone how to read his meter.

We employ 8 meter readers and the average number of meters they read per day is 135, in the residence section, and from 200 to 225 in the business section. Our average cost of reading meters is about 1¼-cents per meter, which includes the extra time spent in going over the routes to read the meters they were not able to get on the first trip, on account of people not being at home.

On the second trip the men leave a postal card which has stamped on it figures representing the dial of a meter. We find this card is very convenient and saves us a considerable expense in reading meters on account of not being able to get into the house on the first or second trip. For those who may not be familiar with this card I

would say in addition to the dial figures there is printed the following: "Our meter reader called to-day and was unable to gain admission to your residence. To save both yourself and Company time, will you kindly draw lines representing hands as they appear on your meter and mail this card."

Some times it is necessary for us to leave from 100 to 150 of these cards. There have been very few cases where the cards have not been marked and returned.

Discussion.

The President—Gentlemen, the discussion of Mr. Wakeman's paper is now before you.

Mr. Barnes—This paper on the subject has been very interesting to me. In small towns where the reading is performed by one or two men, I find they become so familiar with the personal habits of the patrons that, if a meter is placed in a somewhat inaccessible place, they are very apt to estimate the bills without looking at the meter. To overcome that feature I adopted a loose sheet, with a stub attached, that is made up each month, so that the meter reader has no previous guide as to what that meter read on his last visit. He leaves the perforated part of the ticket in the hands of someone about the premises, if possible. If no one is in reach, he leaves it in a place where someone is sure to find it. This is for the purpose of preventing criticism as to how the meter reader got the statement presented. The consumer raises a question and implies there might be some suspicion as to how that bill was made. This slip obviates that criticism and carries with it the information that if they are not familiar with the reading shown by their bill they are to make a diagram such as Mr. Wakeman has suggested with his postal card and return it to the office. The part of slip the meter reader retains has a place provided for him in which to put his reading. At the same time he is required to do a little artistic work in marking a set of dials printed on the slip on the margin of the center—the exact location of the hands as those appear on the meter he has read. We find this prevents a great many errors. By comparing his reading and the illustration we are sure the reader has visited the premises.

Mr. Lloyd—We demand of our men that they read so many meters every day, and if they read in excess of that number we give them a premium. The premium is on an ascending scale for an increasing number; but if an error is made in reading, they have to start over again, and they don't get any premium. Our men are now making, I think, $45 a month in premiums and our meter readings are giving us very much less trouble than they did. We can get on an average a man that will read from 1,200 to 1,400 meters without an error. We have some men who have read meters for 3 years without an error.

Mr. Wakeman—What do they do a day?

Mr. Lloyd—I think our requirement is 400 meters in 3 days' reading.

Mr. Thwing—I have a great deal of sympathy for the meter reader, because I was one myself; it was the first work I ever did in the gas business. There is a great deal of difference between the conscientious and the unconscientious meter reader; but a conscientious meter reader I would prefer should have the last reading of the meter, for the reason that when he puts down the reading he apparently sees on the meter he has frequently a poor light; the meter is frequently in a bad place. He generally compares it with the previous reading, and if anything looks wrong to him he immediately goes back and reads the meter again. When I say I have a great deal of sympathy with the meter reader I will state that for a good many years after I graduated from the meter reading class I used to have the nightmare once in a while, in which I dreamed I was on my meter route, about 3 or 4 hours behind, and was breaking my back to catch up. I think the meter readers for a gas company have got the hardest job of any. They have to listen to complaints against the gas company, against themselves personally, and against the meters. They have to use diplomacy at all times; they have to enter one house by the front door and another house by the back door, and probably go all the way around the block in each instance to do so. I believe the effort of a gas company should be to have conscientious meter readers and then to make their work as easy as possible.

Mr. Ott—I wasn't in time to hear the paper, but I would like to explain our method of reading meters. Men who represent small companies know we get all the experience there is going. We have our meter reading slips made out about 10 inches long, and about 4 wide, with each month of the year on them. When we get through reading meters, before we start on the next month, we cut off that slip, so the meter reader knows nothing about what the meter read before and he has simply got to read the meter. Above all things to obviate mistakes the Beal index is about the only thing there is, and I presume most of those here are familiar with it. The figures underneath the dial are expressed in regular digits. If the consumer wants to read the meter he can read it just the same as he can read any figures. If the reading is 57,000, it is right there; 57,000. It is awful hard to read meters without an error. When the dial figures are standing in a certain position you have to do quite a little calculating, but if you have a Beal index you are always sure you are right. I am very much in favor of a Beal index. They do not cost very much more than the ordinary meter.

Mr. Olsen—My experience is that the first Beal index sent out was not perfect. The hand would sometimes jam backward and sometimes foreward and got our meter reading in a bad shape. The last Beal dial is better, but I don't know that I would recommend it for all meters. They are very nice for the meter readers.

Mr. Barnes—Many things have been said here regarding meter reading, which I think is the least important part of meters. Mr. Wakeman's paper was nearly all taken up by talk on repairing meters, which I think is the more important part. He says meters run all the way from 6 to 30 per cent. slow. If the average meters run 6 per cent. slow, of course, our leakage would be 6 per cent., which amounts to a great deal, and I think every company large or small should take the very best care of leakage. It is a foregone conclusion with large companies, and if it is a fact with large companies it certainly ought to be with small ones. As to meter reading. I fail to see why it is not as easy to read a meter as it is to tell the time of day. The only reason you make a mistake in reading a meter is because you are careless. A man who knows how to read the meter makes a mistake because he is careless. If you ask a meter reader if he knows how to read the meter, he will say, "Yes," and if you ask him why he made the mistake he will say he was careless. The Beal index I don't know very much about, but as far as I do know about it, it was not satisfactory with our companies. Of course, the meter men can all read meters if they want to, and mistakes will occur with human beings, and I suppose as long as we have meters as we have them now mistakes will be made. Of course, with small companies, where we have to take a gasfitter or ordinary man out of the shop to read meters, we must expect to have mistakes. We get the very least—we have one man who, out of 24,000 readings, made only 3 or 4 mistakes, and I think one of our readers read 64,000 meters without making a mistake, and another one read meters for 4 years without an error. You can't expect to get a man just out of a shop to read meters right. It is a pretty hard job. Mr. Thwing said he read meters. I started in the company to read meters, too, and I made more mistakes than any other man we had in the company. We were assessed a fine of 25 cents for every mistake we made, and my fine went up in about 3 years to about $25. It didn't do any good to fine us. Boys will make mistakes. You can't help that, and you have got to overlook those things. In a city like Indianapolis where they have regular meter readers, of course, they demand of them good meter reading.

The President—I can hardly reconcile Mr. Barnes' statement that the wrong reading of meters is due to carelessness with his statement that, when he made mistakes in the reading of those meters, he was conscientious and tried to do his work conscientiously. [Laughter.]

Mr. Barnes—I ask you the question: If you read a meter wrong (I was your foreman), and I would ask "why did you read it wrong; don't you know how to read that meter?" You would say to me "yes; I know how to read that meter." Then when you asked, "Why did you read it wrong?" My reply would be "I was careless, or negligent, or something." You might be a conscientious man and still be careless in reading a meter.

The President—Well, the conscientious man might be careless on one or two occasions, but not very often.

Mr. Dykeman—We have a different method of reading meters from anything that has been given here. Our regular meter readers are our regular meter setters, and it is a part of their work to learn to read meters. They are not put on the payroll until they have become proficient in doing that. The number of meters that are required to be read by our men is 275 to 300 a day.

Mr. Wakeman—I believe a good many of the mistakes made by meter readers are caused by the way the meters are put in the houses. Lots of them are set in some dark hole and the man has to read the meter and carry that in his mind 200 or 300 feet to get to the light to change the numbers. If the meters were put in a good place where it was light, it would do away with lots of mistakes.

The President—Gentlemen, is there anything further on this subject? Mr. Wakeman, the Association is much obliged to you for the labor you undertook in preparing this paper. Mr. Thwing promised me to follow the lecture of Mr. Davis on the subject of "Chemistry of the Gas Business," but on account of the late hour at which Mr. Davis was permitted to give us his lecture, we were obliged to adjourn immediately after he finished it. Mr. Thwing was to have taken up the subject this morning at the beginning of the session, but at that time, being engaged with other business, he was unable to be present. We will now be pleased to have Mr. Thwing come forward and give us the benefit of what he has to say.

Mr. Thwing's Contribution to the Discussion on the Davis Lecture.

Mr. Thwing—What I have to say will occupy but very little time. What I wish to say first is I noted Mr. Davis spoke extemporaneously in his lecture of last evening, and that as the stenographer was absent I am afraid the Association will lose the benefit of his suggestions, some of which were extremely valuable, as also were some of his conclusions, especially those in regard to the testing of gas oils.

Mr. Davis—I have written out my lecture and it will be made a part of the proceedings of the Association.

Mr. Thwing—I shall not criticise Mr. Davis' talk or comment upon it to any great extent, except to say that it was very thorough and very practical. I believe he used the term average sample in speaking of testing coal, and I would like to have him elaborate a little further what he considers an average sample, for that is a subject still in abeyance among the best chemists and among the best chemists in the coal mining field. I find they consider an average sample to consist of from 100 to 1,000 samples of coal. I rather imagine that would be the practice with the gas company. He also stated that a good coal sample should contain about ½ of 1 per cent. sulphur. I believe if we made that specification in buying coal that no coal dealer could meet it. My experience with the best gas coals is that the sulphur content runs from 1 to 2 or even 4 to 5 per cent. I do not believe the requirement of ½ of 1 per cent. of sulphur can be maintained by any dealer in gas coals. Mr. Davis stated that in the sulphur tests the precipitation of sulphuric acid by barium chloride would occupy an hour or two. I have not done anything in chemistry for some time, but when I did the practice was to allow the precipitation to stand for 20 to 24 hours; these were the instructions. I never investigated them particularly, but from my recollection the complete reaction of the barium chloride with the sulphates requires a very considerable length of time. One of the interesting experiments that Mr. Davis carried on was the effect of sulphuretted hydrogen upon the potassium permanganate. I think the members of the Association will find in the records of the Western Gas Association an article by Mr. B. E. Chollar, who was then in St. Louis, showing what was an approximate quantitative test for sulphuretted hydrogen by means of potassium permanganate. I regard the remarks of Mr. Davis on testing gas oils as being the most valuable part of his paper, and I think that everyone in the Association who has occasion to use gas oils should carefully read over and study his comments thereon. One point on which I somewhat differ from Mr. Davis is on the fractional distillation of gas oil. I started doing that 15 or 16 years ago in connection with the manufacture of gas, beginning by taking a definite number of degrees and ascertaining the amount of oil which was driven off between two separate temperatures. I found later that I could get more valuable results, so far as comparative purposes were concerned, by fractionating the oil in definite fractions; that is, in $\frac{1}{10}$ actions, and finding out the temperatures between which these definite fractions were driven out. It is largely a means to the same end, but I believe the latter gives a better method of comparing gas oils. In this connection I will say I tried to find out exactly what fractionating gas oils means, and up-to-date I am in ignorance. I used to take these fractions and test them for gravity, which gave me some information, but I do not know of any published information which separates the oils into their different commercial gradations or definitions based either upon temperature or upon gravity.

Mr. Davis—Replying to Mr. Thwing's question about the precipitation of sulphuric acid by barium chloride requiring 12 to 24 hours, I will say the precipitation of acid by this reagent takes place very readily, especially if heat be applied, and after adding the reagent to the solution and boiling the barium, sulphate is ready immediately to be filtered off and weighed. There are, however, far more rapid methods than the precipitation of sulphate by barium for the estimation of sulphur in coal and coke. I may mention the method of Drs Morden and Pennock, and those of the Solvay Process Company, of Syracuse, N. Y., through which they estimate sulphur by adding a solution of barium chromate to the dissolved sodium peroxide fusion, titrating the liberated chromate acid with an iodine solution of known strength. The estimation of sulphur by this method may be accomplished in 35 to 40 minutes. This is perhaps the most rapid method known. In order to obtain an average sample of coal when several thousand tons are being sampled, a small quantity, preferably a bushel or two, should be taken from each car, and when all the cars have been sampled the samples are mixed, cracked up and quartered several times, until the volume of the sample has been reduced to a few pounds. This is then further powdered until it will pass a 100-mesh screen, when it is ready for the laboratory. I have had samples handed me, which consisted of only one lump, which were to represent a carload or even several carloads of coal. Such a sample, of course, is inadequate, for an analysis made on it would be nothing more than a guess, since a lump of this kind might contain a large piece of slate or iron pyrites, which would make the ash or sulphur run very high; in fact, far in excess of the average coal in the cars. If Mr. Thwing will remember my exact statement of last evening in regard to the quantity of sulphur in a good gas coal, I said it was a good gas coal that contained not more than 1 per cent. of sulphur, although a coal containing two per cent. of sulphur may be used, and in many cases is used, provided its other qualities are such that its use is warranted. I have found samples of coal as low as ½ to 1 per cent. of sulphur, and I believe the average in good gas coals is somewhere between ½ and 1 per cent. As to the test for sulphuretted hydrogen with potassium permanganate, I wish to say I have made no claim to originality in this test; in fact, on none of the tests which I have shown here, since all of them are merely methods used in average, up-to-date gas laboratories.

Mr. Thwing—Mr. Davis passed my question in regard to the fractionation of gas oils, whether that is best done by volume or by temperature.

Mr. Davis—I prefer to fractionate gas oils according to temperature, since the carburetter of a water gas machine must be run at such a heat that it will crack up the main volume of the gas oil, even though the light oils be cracked into lampblack and hydrogen, the heavy residue in the oil going out with the tar. The fractional distillation of the oils according to temperature will enable the chemist to judge the molecular composition of his oil, and also to judge the best temperature for the carburetter of the water gas machine to crack up the main volume of his oil. For that reason I prefer to run fractional distillation of gas oil according to temperature.

Mr. Mulholland—I listened with a good deal of pleasure to the paper last night, and to the discussion of to-day. I am associated with one of the companies of the State that, probably outside of Indianapolis, could about as well afford to have an elaborate testing outfit as any other company in the State outside of Indianapolis; we have not got it. Now, this has all been very interesting. The gas oil proposition is something that I think is of the greatest importance. I think, as was clearly demonstrated last night, it behooves us to know exactly what we are getting when we buy gas oil. The same condition exists in regard to coal, and in respect of residuals, our ammonia and our tar. But the thought occurred to me, how are the small gas companies over the State, and some of them are not so small either, how are we to arrive at this data and information that has been so ably presented by Mr. Graf. We cannot afford to employ a man of that capacity; we cannot afford to go into it in that way. I will say, Mr. President, my remarks merely lead up to the suggestion, which I believe is a good one, and in which I believe every member of this Association will concur, that it is of vast importance to us to know what the conditions in gas manufacture are regarding gas, oil, coal, coke, tar, ammonia, etc. Would it not be a good idea for this Association to appoint a committee to take up the question of the advisability of providing a means whereby each of the gas companies in the State would be able to send samples of their gas, oil, coke, coal, tar, ammonia, etc., to some competent chemist for the purpose of securing definite, detailed information and data. I don't believe anything else we could do in our meeting would result in greater benefit and advantage to the various gas companies over the State. While I am not putting it in the form of a motion, it occurred to me, during the reading of this paper and the discussion thereon, that it would be a good thing if we appointed a committee to take up the question of the advisability of getting, at a nominal expense to each company, an arrangement that would enable them to have not only their materials and residuals, but their gas analyzed

and the report and date sent to them as the result of the analysis.

Mr. Barnes—I believe the Michigan Gas Association members have a way of testing these coals, oils, gas, etc. Perhaps Mr. Lloyd could tell us about it in detail.

Mr. Lloyd—The Michigan Gas Association keeps two men at the University of Michigan, where they have all the appliances necessary to make tests. The gas companies of the Association all contribute so much apiece annually. These two men do all sorts of experimental work, and make all kinds of tests, and any gas company that wishes to have any work done can send it to the University of Michigan and have it done. Experiments are made with samples of gas from Ann Arbor and very valuable results are being obtained in this way.

Mr. Graf—I would like to make an offer to this Association. The Indianapolis Gas Company has an excellent laboratory and Mr. Davis, our Chemist, can probably find time in which to do work of this kind for the members. We would endeavor to make the charge as nominal as possible, and I am willing that the revenue from such work should go to Mr. Davis personally.

Mr. Mulholland—In accordance with Mr. Graf's very kind proposition, which I am sure is appreciated by the members of this Association, because none of us have that outfit, I move that a committee of three be appointed by this meeting to confer with Mr. Graf and Mr. Davis as to the matter and send forth to the members of this Association a circular letter explaining what they are prepared to do, and an approximation of what it will cost to each gas company for the various tests that would be worked out.

The President—Gentlemen, you have heard the motion that a committee of three be appointed to confer with Mr. Graf and Mr. Davis in reference to analytical work which may be required of them by the gas companies of the State, etc. All in favor of that motion will say "Aye;" all opposed, "No." [Carried.]

The President appointed as such Committee Messrs. Mulholland, Pickens and Barnes.

Vote of Thanks to Mr. Graf.

Mr. Barnes—I would like to make a motion to thank Mr. Graf very much for his kind offer. [Seconded and adopted by a rising vote.]

The President—I take great pleasure, Mr. Graf, on behalf of the Association, in thanking you most heartily for your very kind offer, which has been accepted. Gentlemen, this closes our programme proper. There is a proposed amendment to our by-laws, of which you all have received notice. It is as follows:

Amendment to the Constitution and By-Laws.—Section 5, Paragarph 17. To be amended to read as follows: The officers shall consist of a President, Vice-President, Secretary-Treasurer and 6 Directors. The President, Vice-President and Secretary-Treasurer shall be elected annually by ballot, and assume office on the 1st day of the month next following their election. Two Directors shall be elected annually by ballot to serve 3 years, and shall assume office on the 1st day of the month following their election.

Gentlemen, notice has been given in accordance with the Constitution as to this amendment and it is before you for adoption or rejection.

Mr. Graf moved the adoption of the amendment, and the motion was seconded. The President ordered a ballot, and subsequently announced that the amendment had been adopted.

The President—The next business, I believe, is the election of new members.

Election of New Members.

The Secretary—All of these, with the exception of one or two names, that have been received during the day, have been passed upon by the Executive Committee in accordance with the by-laws. The names are:

Asendorf, C. F., Chicago.	Forrest, J. D., Indianapolis.
Ayres, A. B., Fortville.	Fritsch, C. H., St. Louis.
Blank, C., Martinsville.	Gaddis, G. M., Shelbyville.
Bolds, D. P., Indianapolis.	Hicks, G. C., Jr., Connersville.
Booth, W. F., Hammond.	Kunz, G., Lawrenceburg.
Cressler, G. H., Fort Wayne.	Lloyd, A. G., Adrian, Mich.
Cunningham, J. R., Toledo, O.	Mulholland, S. E., Fort Wayne.
Dales, J. S., Franklin.	Oviatt, J. E., Indianapolis.
Dell, J., St. Louis.	Perkins, J. A., Richmond.
Donovan, E. L., Logansport.	Pickens, A. G., South Bend.
Draper, C. E., Sullivan.	Summers, G., Indianapolis.
Dykeman, J. H., Evansville.	Walsh, E. J., Indianapolis.
Freese, F. W., Fort Wayne.	Wishard, T., Lafayette.

These gentlemen named were subsequently declared elected to all the privileges of membership.

Report of Committe on President's Address.

The President asked for the Report of Committee on the President's address, which was made by Mr. Graf, as follows:

Mr. Chairman and Gentlemen: We have in this address an able exposition of the vital points regarding the gas industry at the present day. Our President has brought out many facts which, if known to and thoroughly understood by the general public, would convince them that we are giving to the public the best service at the lowest cost, and would lead to the adoption of a policy of conservatism as against the drastic legislation that we are now subjected to. The ratio of the small income to capital necessarily invested, is a matter that is known to but few of those who condemn us. We fully endorse our President's assertion that 6 per cent. on capital invested, is not a sufficient return to guarantee to our consumers the best service at the lowest cost, or safety to investors in our securities.

In view of the Bureau of Information, maintained by the American Gas Institute, and which is available to all our members, we do not feel that a similar committee is at present necessary in our own Association.

The disposal of residuals, as well as obtaining the best possible return for same, is one of the most important problems we have to meet. We would, therefore, strongly recommend that, in line with our President's suggestion, a committee of three be appointed to investigate these matters, and devise, if possible, some way in which this positive division of our business may be carried on more systematically, and with better results financially.

Respectfully submitted, Carl H. Graf, E. A. Wakeman, B. S. Walters, } Committee.

On motion, properly seconded, the report and its recommendations were adopted.

Mr. Mulholland—As a sequel amendment to that, I move the members of this Association extend to the President their thanks for his efforts during the past year, and that the vote be a rising one. [Seconded.] All in favor of this amendment please rise. [Every member arose.]

The President—Gentlemen, a real pleasure in life is the evidence of appreciation for efforts that one may have undertaken, and if I have done anything to deserve your approval, I am sure it is the greatest pleasure I can enjoy. In accordance with the recom mendation of the Committee I will appoint as a Committee on the Disposal of Residuals Messrs. Davis, Rowland and Barnes, of Columbus. These gentlemen are located near Indianapolis and can easily get together.

The President called for the

Report of Committee to Name Next Meeting Place.

Under the call majority and minority reports were submitted. The first (presented by Mr. Barnes) named Indianapolis, and the second (by Mr. Dykeman) favored Evansville. The majority report was sustained.

The President—Our last duty, gentlemen, is the

Election of Officers.

Mr. O. O. Thwing, Chairman of the Committee on Nomination of Officers, handed in the following report:

To the Indiana Gas Association: Gentleme n—Your Committee on Nomination of Officers for the ensuing year begs to report as follows:

In consideration of the fact that the officers of the present meeting have served for only a portion of a year, and believing that the best interests of the Association will be conserved by retaining them in office for the ensuing year, we unanimously recommend the election of the following:

President.—J. W. Dunbar, New Albany.
Vice-President.—W. B. McDonald, Evansville.
Secretary and Treasurer.—Philmer Eves, Indianapolis.
Directors.—S. T. Murdock, Lafayette; C. H. Graf, Indianapolis; B. S. Walters, South Bend; S. E. Mulholland, Fort Wayne; E. A. Wakeman, Terre Haute; S. C. Rowland, Crawfordsville.

The President—Under the amendment to the constitution just adopted it is proper to elect our Directors for 1, 2 and 3 years.

Mr. Graf—I would suggest we put the names in a hat and draw from it. The first two for 3 years; the second two for 2 years; the third two for 1 year.

Mr. O. O. Thwing—I move that the Secretary be instructed to cast the ballot for the officers named by that Committee, and that the Directors to serve 1, 2 and 3 years be selected by drawing from the hat. [Seconded and carried.]

The Secretary having in due time reported that the instructions had been followed, the names of the gentlemen reported by the Committee were declared those of the officers for the ensuing years. The drawing by lot in respect of the Directors for long, middle and short terms was thus reported: Directors, 3 years, Messrs. Wakeman and Mulholland; 2 years, Messrs. Murdock and Walters; 1 year, Messrs. Graf and Rowland.

RESPONSE OF THE PRESIDENT.

The President—Gentlemen, I thank you for the honor. This year our convention has been like a new piece of machinery; some of the parts not worn down. I am sure by the time our next convention rolls round we will have made some improvement and that the next meeting will be one superior to this. I wish to give my personal testimony to the very efficient manner in which our Secretary has performed his duties, and whatever success this meeting has had the credit is due to no one so largely as to Mr. Eves.

A MORTUARY RESOLUTION.

Mr. O. O. Thwing—I would like to ask permission to introduce a resolution:

"*Whereas*, We learn, with deep regret, of the sudden death of Mr. H. W. Thomas, of Auburn, Ind., one of the organizers of this Association, who died on January 15, 1909,

"*Resolved*, That we extend to his family and his business associates our condolences and sincere regrets."

The motion was seconded.

The President—Gentlemen, you have heard the motion of Mr. Thwing with reference to the death of one of the organizers of this Association, Mr. H. W. Thomas, of Auburn. All in favor will please rise. [Adopted unanimously.]

Mr. Barnes—I want to suggest that every member of the Association should put his shoulder to the wheel and try to get new members, and to make this Association a live one in every sense. I will promise to furnish one if every other member will promise to furnish another one.

The President—We will all do that and we thank you for the interest you take in the Association. I wish each member would bear in mind the suggestion of Mr. Barnes that we make this Association a live one. I believe there is opportunity in Indiana, and the material too, that by united effort we can cause the Indiana Gas Association to equal any other gas association in the country. It requires only our united efforts to do it. I feel, from the interest taken in this meeting, that everyone will put forth his utmost effort to make the Association a success.

VOTES OF THANKS.

Mr. Mulholland—I believe it is customary in Associations of this nature to have the last motion presented before the Association on a formal resolution to extend a vote of thanks from the Association to all of its officers who have devoted their time and energy to the success of the Association during the past year. I, therefore, make that as a motion. [Seconded and carried.]

The Secretary—Perhaps I may be permitted to express my thanks to Mr. Mulholland for proposing that motion, and to all of the members for having carried it, and to say that had it not been for the individual efforts and the great amount of work performed by the Executive Committee this meeting would not have been the pronounced success that it has been. I feel personally indebted to all those gentlemen for the very valuable assistance they have given, and on behalf of the officers of the Association I tender you our thanks for your resolution. [Applause.]

The President declared the sessions adjourned.

Figures from the Berlin (Germany) Gas Works.

Under date of March 21st, "R. W. H.," writing from Leipzig-Plagwitz, forwards the following interesting figures respecting the operation of the Berlin Municipal Gas Works:

I send you the following summary of the operations of the plant owned and operated by the municipality of Berlin, Germany, which figures cover the work accomplished for the year ended December 31, 1908—the fiscal year ends March 31 of each year. The ton of coal was taken at 2,250 pounds, 1 cubic meter at 35.2 cubic feet. The greatest output in the 24 hours was 1,175,000 cubic meters, equal to 8,435,253,600 cubic feet. The total production was 252,980,000 cubic meters, equal to 8,935,253,600 cubic feet. The gas contained 0.12 grains NH_3 and 1.96 grains CO_2 in 100 cubic meters, equal 0.04 grain NH_3 and 0.5 grain CO_2 in 1,000 cubic feet. Succinctly stated, the main features of the operation were—the plant is of the combined coal and water gas type:

1. *Coal Gas*—
   - Total consumption of coal = 750,506 tons, 47 per cent. German and 53 per cent. English coal.
   - Total production of coal gas = 237,366,000 cbm. = 8,383,767,000 cubic feet.
   - 1 ton of coal = 316.3 cbm. = 1,170 cubic feet gas.
   - Firing retorts 190 kg. per ton coal = 365 pounds per 1,000 cubic feet.
2. *Water Gas*—
   - Total consumption of coke = 13,077,710 tons = 53.2 pounds per 1,000 cubic feet.
   - Total production of gas = 15,580,000 cbm. = 550,285,600 cubic feet.
   - Oil consumption = 0.227 kg. per 1 cbm. = 14.4 pounds per 1,000 cubic feet.
3. *Firing Boilers*—
   - Equals 4,718,440 tons = 0.303 kg. per 1 cbm. = 19.2 pounds per 1,000 cubic feet gas.

Distribution.

How Distributed.	1907-08. Cubic Feet.	1906-07. Cubic Feet.	Per Cent. of Total Delivery. 1907.	1906.	1905.
By meter to ordinary consumers	7,390,464,845	6,918,939,420	82.7	83.6	83.6
By prepay meter to ordinary consumers	571,069,800	475,921,990	6.4	5.7	5.0
By tariff	45,907,595	47,766,800	0.5	0.6	0.6
Total consum. by ordinaries.	8,007,442,240	7,442,628,210	89.6	89.9	89.2
Gas consumption in plants.	110,350,770	97,497,360	1.2	1.2	1.1
Gas consumption for street lighting	536,152,160	496,669,240	6.0	6.0	6.2
Total delivery	8,653,945,170	8,036,794,810	96.8	97.1	96.5
Not figured (loss)	281,308,430	241,612,750	3.2	2.9	3.5
	8,935,253,600	8,278,407,560	100.0	100.0	100.0

Producers and Secondary Air Supply.

In a paper prepared on this subject for the last meeting of the Scottish Junior Gas Association, the author (Mr. F. Cuthbert, of Perth) remarked:

I shall consider only the ordinary local producer supplying not more than 24 mouthpieces (one through bed), and I have chosen the title of "Producers and Secondary Air Supply" because I believe it embodies the elements of successful carbonization. It is recorded in the proceedings of the North British Association of Gas Managers for the year 1902 that, for the economical production of gas, the temperature of the retort must be maintained at 2,000° F.; and to accomplish this all that is required is a gas producer constructed to contain a sufficient quantity of coke, disposed in such a manner as to provide a regular supply of carbon monoxide of good quality to the setting.

That the producer should be larger is a common, indefinite statement. A fuel bed area of 1 superficial foot per 10 lineal feet of retort floor should be the minimum for local producers supplying 18 to 24 mouthpieces. The common form of producer is rectangular, giving (compared with the circular form) a large wall surface for the formation of clinker in proportion to its area. Producers for single retort-settings—that is, two producers to the through bed—should have an area of 1½ superficial feet per 10 lineal feet of retort.

In some works, the producer is contracted near the bottom for the purpose of diverting the primary air and water vapor to the center of the fuel bed. This method rather intensifies the clinker difficulty. The bell mouth of the Perth producer provides a repository for the ash at the sides, and which ash lies close and prevents the passing of air near the walls, thereby reducing clinker. This form affords also a relatively large furnace-bar area and a correspondingly slow passage of the air and water vapor at this point. The furnace works with a very moderate draught. The producer bars are shaken regularly, but clinkering is only necessary at intervals of about six days.

It is assumed that the producer inlet and clinkering doors have planed faces, and that when sufficient water vapor is not available from the water or ash-pans, a regular supply of steam is admitted. The end of the steam pipe should, however, be sealed in the water-pan, as direct steam is not uniformly advantageous. The supply of water to the drip plates should only be sufficient to supply water vapor, not enough to cool the plates and "douche" the fuel. A separate regulated supply of water should be provided for the ash-pans. The spaces between the drip plates should be closed with small ash from the ashpans.

The furnace bars should be set as nearly level as practicable. Wrought iron bars, 1 inch square in section, seem to give the best results. They cause a very fine division of the air, are easily handled, and are very durable. Angle bars require to be set with a slight declivity, to distribute the cooling water throughout their length. This section of bar has certain disadvantages—chiefly, that it is too large, occupying an undue amount of grate area, and increasing the velocity of the air through the limited spaces which it affords; and if the interval between the bars is increased, the loss of fuel during pricking operations or shaking of the bars is serious.

The work of the producer attendant is the most arduous in the modern retort house. His comfort should, therefore, be considered, and proper facilities provided in a well-designed producer. We have at Perth a form of producer which can be clinkered from below with a minimum of trouble; and the sloping front is a feature of it which is greatly appreciated by the workmen. It is always free from clinker and facilitates the spreading and levelling of the fuel, which latter operation, strictly carried out, adds 5 per cent to the mouth-piece yield of gas.

The heating of the secondary air is another simple operation, but is more often than not, I think, made difficult by attempting to lead the air in circuitous ways through ingeniously formed channels, from which the bulk of it often wanders through unknown crevices to the waste-gas flues. For this reason, most likely, the South Metropolitan Gas Company are content to warm the air in the solid walls of the setting in what is known as the generator system. I am not commending the generator system; but the case stated is one which has many parallels, and should emphasize the importance of stability and simplicity in the formation of air-channels. I make bold to say that the average regenerator (so-called) is hotter in the last waste-gas flue than most of the simple generators, as the result of the evils of short-circuiting. Cracks in the walls of the flues or channels occur most frequently near the front of the oven, where, owing to exposure to the air, the brickwork is not fluxed together as in other parts of the setting. It is wise, therefore, to stop all air-channels short of the front wall and form them off separately and independently.

Mr. Newbigging says that "dry air * * * takes up heat with extreme rapidity when brought in contact with a hot surface;" also "it is not necessary that the hot flue passage through which the secondary air is caused to travel in order to be heated before coming in contact with the combustible gases from the generator, should be long extended and tortuous in its course." It follows, therefore, that a vertical flue, leading direct to the combustion chamber, will provide ample travel for the proper heating of the secondary air, and insure its delivery at the floor of the combustion chambers—thus making short-circuiting next to impossible. These vertical "uptakes" afford means to control the supply of air to different parts of the setting, which is an advantage.

In bringing the air and gas together, it is convenient to have all the ports on a perfectly level and accessible floor. Long, narrow ports are preferred by some engineers. Ports 7 inches long by 3 inches wide are doing excellent work at Perth; but other ovens with ports 4 inches square are doing equally well. The latter are more substantial, however, and cost less to build. The air ports terminate 9 inches from the inside face of the wall supporting the front of the retorts, or 4 feet 11 inches from the outside face of the bench, at the area floor, where the air enters the combustion chamber.

Items of Interest
FROM VARIOUS LOCALITIES.

MR. W. L. POWERS, Superintendent of the gas division of the business of the Decatur (Ills.) Railway and Light Company, is evidently bent on putting his house in order. Further, his Directors seem to be of the active sort, for, noting that there is a good exercise in the artificial lighting business in Decatur, they take due advantage of the fact that the time to make contracts for apparatus is when the apparatus manufacturers are comparatively idle. However, they have just closed contracts with the Gas Machinery Company, of Cleveland, O., for new coal gas apparatus, including purifiers and water gas apparatus, together with connections and miscellaneous machinery. Supt. Powers has also mapped out a plan that calls for perhaps 134 miles of main extensions.

A CORRESPONDENT in Los Angeles, Cal., writing under date of March 24th, says: "While Mr. James E. Stacey, 'The Veteran,' was on the Coast last week, among other things that he did was to secure the contract for the complete work of the Imperial Valley Gas Company, which is to be located at El Centro, Cal. This plant, although small at the start, is eventually intended to supply five rapidly growing towns in the Valley, and is built along lines similar to those of the Domestic Gas Company, of Los Angeles. The San Joaquin Light and Power Company has decided to overhaul the plant at Selma, Cal. To that end the proprietors have ordered a new steel holder, together with complete overhauling of the plant necessary to put the same in first-class working condition."

"A. S. R.," writing from Louisville, Ky., under date of March 26th, informs us that hereafter the Anchor Stove and Range Company, of Louisville, Ky., will be on the road in certain districts according to this schedule: In the South, by Mr. W. B. Miller, who will be known from his former connection with the Birmingham (Ala.) Gas Company; in Indiana and Ohio, by Mr. C. C. Rundell; in Kansas and the Southwest, by Mr. Curry Dougherty.

"L.," IN a line or two from Raleigh, N. C., notes that the following may prove of interest to your readers: "On the 26th of March, James McCullum and Oscar Hall, two negro boys, were sentenced to 12 months on the county roads for rifling the boxes of prepayment meters. In addition to the instances proved under which they were convicted at least a dozen more cases could have been cited. The culprits were unusually intelligent for their years and evident training, one of them, at request of Counsel, naming the States of the Union and the capital of each."

WE understand that a sensible plan of reconstruction is proposed for the works at Monroe, Wis. The main system also to be largely extended.

THE annual meeting of the head men in the service of the United Gas Improvement Company was held in Philadelphia the week ended March 20th. The meeting was carried on comparatively in secret this year, as may be readily gleaned from the fact that reporters of some of the leading Philadelphia newspapers, when on the scout for news said, regarding the Convention, that "the business to be transacted was purely technical, and of interest to Company employees only, being a 'family conference' to devise improved methods for handling the details of the manufacture and disposal of gas." We can and do say, however, that the numbers were replete with interest.

MR. B. F. FULTON, of Portland, Ind., has been appointed a Deputy State Gas Inspector. This appointment is made under the law passed by the Indiana Legislature, which provides for the inspection of every abandoned oil and gas well in the State. This measure had its inception in the belief that the improper plugging of many of these borings had resulted in the accumulation at certain creeks of salt water that was polluting the fresh water supply of thousands of the everyday wells on which hundreds of thousands depended for their daily supply of potable water.

REPRESENTATIVE MONAST, of the Rhode Island House of Representatives, has introduced a bill to that body which authorizes the Governor to appoint a State Inspector of gas and gas meters and of electric meters. The term of office is for 3 years, the salary is to be $1,200 (and travelling expenses), and meters are to be tested in the cities of the State, at times designated by the Inspector, when he shall be present according to a route or itinerary to make such inspections. The fee for each meter tested shall be 50 cents, which fees, up to an aggregate of $500, are to be used in paying deputies—it is written in the bill deputies, not deputy. And how shall the deputy fare, with $500 confronting him, ex-travelling expenses? This bill will have to be done over, else filling the positions created by it will certainly be a difficult task.

THE Brockton (Mass.) proprietors are going to overhaul their main system this summer. The plans call for many substitutions and for extensions, totalling not less than 4 miles.

THE case of Pearson v. Boston Gas Light Company was one of tort for personal injuries. In the Supreme Court (Harris, Judge) ordered a verdict for the defendant, and plaintiff excepted. On appeal, before Judge Hammond, the case was reargued, and subsequently the Judge filed the following decision: While at work upon a bench in the defendant's workshop, trying by the aid of a wrench to fit an elbow to a piece of gas pipe, the plaintiff fell to the floor and was injured. Upon the evidence the jury may have found that the fall was caused by the slipping of a wrench, or by a hole in the floor; and they could have found that the injury would not have happened if the hole had not been in the floor; or, in other words, that the hole in the floor was the proximate cause of the injury. Even if it be assumed that the plaintiff was in the exercise of due care, still there is a fatal defect in his case. There is no evidence that the defendant failed in any duty it owed him. There was no trouble with the wrench or with the vise which held the iron. Nor can the plaintiff justly complain that he received no instruction as to the way in which to use the vise or the wrench. He testified that at the time of the accident he "was 39 years old; that he had been working at the machinist's trade 16 years; that while he had been a machinist he had used a machinist's vise almost every day of his life; that he had used wrenches off and on all that time; that he had used two kinds of wrenches; that he knew how these kinds of wrenches worked;" and, "that a wrench is used to grip something, so that one can turn it;" and although he testified that the "machinist and the piping trade" were "distinct [and] two different lines," that he "never turned a round object with a wrench in his 16 years' experience," and that "it was not in his line of work to use small iron pipe," still he had been in the employ of the defendant as a machinist for 4 years, and the defendant was fully justified in considering that so experienced a man needed no instruction how to use the wrench in the work he was called upon to do, and it owed him no duty to instruct him in the matter. Indeed, a self-respecting man of the experience of the plaintiff might well regard an offer to instruct in such a matter as an implied imputation upon his intelligence. Nor did the defendant owe the plaintiff any duty about the hole in the floor. It is well in this connection to get a clear conception of the general character of the workshop. It was a machine shop. The room in which the defendant was at work was 75 to 80 feet long and about 30 feet wide. The floor consisted of planks laid upon the ground, which do not seem to have been fastened to anything. They were laid side by side, and manifestly there must have been inequalities in the surface of the floor. There were many windows in the room, but the evidence tended to show that the light was obstructed considerably by the machinery scattered about, and by the grease and dirt upon the glass. A large door through which the workmen passed to and from their work was near the place where the hole was. The hole was about 12 inches long, 9 inches wide and 5 inches deep, and existed because one of the floor planks was a little short. As one witness described it, "There was two long planks and a short one. That makes the hole." The hole was "right by the end of the bench" at which the plaintiff was working at the time of the accident, and was "2 feet beside the vise." The plaintiff had passed in and out of that door twice every working day. There was a small door which was a part of the large door, and sometimes only the small door was opened as the plaintiff went in and out. This hole was plainly to be seen and was one of the obvious risks of the business as carried on by the defendant, and we think that the defendant could not reasonably have anticipated the need of any information as to its existence, or the need of any warning to be careful. It was exactly what might be expected to exist in such a floor in such a room used for such purposes as was this room. There was no evidence of any change since the plaintiff entered into the defendant's employment. The case differs plainly from cases like Falardeau v. Hoar, 192 Mass. 263, and Haworth v. Pocasset Mfg. Co., 167 Mass. 225, and others of a similar nature upon which the plaintiff relies. As said Loring, J., in McCafferty v. Lewando's French Dyeing and Cleansing Co., 194 Mass. 412, 414. "It is one thing to open a trap door and leave it unguarded, and another to maintain a hole all the time which is obvious to anyone who looks on the floor in which the hole is." The present case must stand in the class with the case last cited, which see, with the cases therein cited. In view of the ground upon which the decision of the case is placed, it becomes unnecessary to consider the rulings upon the admission and rejection of evidence. We see, however, no error in this respect. Exceptions overruled.

THE Parker-Russell Mining and Manufacturing Company seems to be getting its share of current work. Recent orders on its books indicate the refilling of 8 benches of 9's in the Seattle (Wash.) works; 5 refillings in benches of 6's at the Racine (Wis.) works, and a good order from the proprietors of the gas plants at Fargo, N. D., and Kankakee, Ills., respectively. We further understand that the Company has been awarded a large contract in a Southern city, but we have not been officially advised thereof.

AT the annual meeting of the Mount Carmel (Pa.) Company Secretary Fisher's report for the twelvemonth showed that business had been very brisk with the Company. He recommended that a new storage holder be erected and that a siding from the railway to the generating house should be put down. The officers elected were: Directors, John E. Bastress, Robert Muir, J. B. Kauffman, John Karl, F. W. Green, F. B. Fisher and J. F. Halfenstein; President, John E. Bastress

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THE proprietors of the Grand Rapids (Mich.) Gas Light Company have announced an important concession in rates, to become effective May 1st. Net per 1,000 cubic feet, 2,000 to 50,000, 80 cents; 50,000 to 100,000, 70 cents; 100,000 to 200,000, 60 cents; all above, 50 cents. These quantities, of course, are on a monthly reckoning.

JOHN DONOVAN, a night watchman in the employment of the Stamford (Conn.) Gas Light Company, was discovered dead, in the governor house of the Company, the morning of March 24th. Death was due to asphyxiation, and Medical Examiner Sherill, on examination, certified that it was accidental. The correspondent who informed us of the happening also inclosed the following mention of the case as it appeared in the Stamford *Advocate*: "The asphyxiation was due to the slipping of a hose connecting a small gas heater with a gas supply pipe on the wall of the room. The end of the hose, which had been fastened to the heater, got loose, probably while the man was asleep, and he subsequently fell to the floor, having inhaled gas. The building was heated by steam and the Superintendent was not aware that the watchman was using the gas heater, which was of small size. The accident was discovered by Superintendent Waters on his morning visit to the house to change the recording chart. Deceased had been in the Company's service several years."

WHAT is known as the gas income bill some days ago was unanimously passed by the Pennsylvania House of Representatives. The bill provides that a tax of 5 mills shall be levied on the capital stock of all Companies engaged in the manufacture of gas, and that 8 mills on the dollar of their gross receipts shall be turned into the State Treasury.

MR. J. C. LEAR has resigned from the position of Treasurer of the Owosso (Mich.) Gas Light Company, and also from its Board of Directors. His successor has been named in the person of Mr. Gieve, of Ann Arbor.

AT the annual meeting of the Vincennes (Ind.) Light and Power Company the officers elected were: President, E. M. Deane; Vice-President, M. S. Rooney; Treasurer, R. E. Preble; Secretary, F. G. Deane.

THE projectors declare that the proposed gas plant for Billings, Mont., will be constructed forthwith. Meanwhile, the $5,000 check, which was to have been deposited with the authorities as a guarantee that the work on the pipe lines would be taken up before the 1st prox., has not been deposited.

WORK has been commenced on the office building for the Western United Gas and Electric Company's branch at Joliet, Ills. It is to be 2 stories in height, the front is to be of Bedford limestone, the body to be of pressed brick. The finishings will be in hard wood, and the structure complete will make a very prominent addition to the business buildings of Joliet, which place was known to gas men of 20 years ago, chiefly as the home place of "Mike" Moran, whose sturdy figure and strident voice were in order at many a meeting of the Western Gas Association.

AFTER the 1st prox., the rate at Owensboro, Ky., will rule at $1 per 1,000. Mr. G. M. Gaddis succeeds Mr. Norris as Superintendent in the named place.

The Market for Gas Securities.

The shorts are again in a quandary, also in a box, over the gyration of Consolidated gas. It managed to cross 140 this week, but realizing sent it back 2 or 3 points. The readjustment of capital to property ownership, of one sort or another, will undoubtedly next engage the owners, and this being so there is no reason why Consolidated should not sell at 175 before Independence Day. This may look an odd prediction, but 'tis quite near the truth nevertheless.

Brooklyn Union is also about ready to share in a financial pyrotechnic, and the increases are intimating that there will be quite a shower of stars in the display. Peoples, of Chicago, is certainly doing its aeroform movement with grace and precision. The bond market holds active and firm.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

APRIL 5.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share:

N. Y. City Companies,	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated Gas Co.	$73,177,000	100	138¼	138⅜
Central Union Gas Co.—				
1st 5's, due 1972, J. & J.	3,000,000	1,000	98	101
Equitable Gas Light Co.—				
Con. 5's, due 1932, M. & S.	1,000,000	1,000	—	105
Mutual Gas Co.	3,500,000	100	145	155
New Amsterdam Gas Co.—				
1st Con. 5's, due 1948, J. & J.	11,000,000	1,000	100½	102
New York & Richmond Gas				
Co. (Staten Island)	1,500,000	100	37	43
1st Mtg. Gold Bds. 5 p. ct.	1,000,000	—	100	101
New York and East River—				
1st 5's, due 1944, J. & J.	3,500,000	1,000	104	107
Con. 5's, due 1945, J. & J.	1,500,000	—	97	101
Northern Union—				
1st 5's, due 1927, J. & J.	1,250,000	1,000	94	100
Standard	5,000,000	100	—	75
Preferred	5,000,000	100	70	100
1st Mtg. 5's, due 1930, M. & N.	1,500,000	1,000	100	105
The Brooklyn Union	15,000,000	1,000	135	136
1st Con. 5's, due 1948, M. & N.	15,000,000	—	91½	92
Yonkers	299,650	500	130	—
Out-of-Town Companies.				
Bay State	50,000,000	50	1¼	1⅝
" Income Bonds	2,000,000	1,000	—	75
Binghampton Gas Works	450,000	100	—	65
" 1st Mtg. 5's	500,000	1,000	90	96
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	5	8
Bonds, 5's	5,250,000	1,000	60	60¼
Capital, Sacramento	500,000	50	—	35
Bonds (6's)	150,000	1,000	—	—
Chicago Gas Co. Guaranteed Gold Bonds	7,000,000	1,000	104	106¼
Cincinnati Gas and Electric Co.	29,500,000	100	91¼	92
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	96	98
Columbus (O.) Gas Lt. & Heating Co.	1,682,750	100	90¼	91
Preferred	3,026,500	100	75¼	80
Consumers, Toronto	2,000,000	50	200	204
Consolidated, Baltimore	11,000,000	100	—	105
Mortgages, 6's	3,600,000	—	—	118
Chesapeake, 1st 6's	1,000,000	—	—	—
Equitable, 1st 6's	910,000	—	—	—
Consolidated, 1st 5's	1,490,000	—	—	112
Consolidated Gas Co. of N. J.	1,000,000	100	15	17
Con. Mtg. 5's	880,000	1,000	92	95
Bonds	75,000	—	—	100
Denver Gas and Electric	458,000	—	102	105
Detroit City Gas Co	5,000,000	50	—	50
" Prior Lien 5's	4,619,000	1,000	97	100½
Detroit Gas Co., 5's	381,000	1,000	75	80
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	—	101
Essex and Hudson Gas Co.	6,500,000	—	39	40
Fort Wayne	2,000,000	—	—	—
" Bonds	2,000,000	—	55	—
Grand Rapids Gas Light Co., 1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	190	200
Kansas City Gas Light Co., of Missouri	5,000,000	100	—	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede Gas Co., St. Louis.	10,000,000	100	—	100
Preferred	2,500,000	100	60	90
Bonds	10,000,000	1,000	104	104¼
Lafayette Gas Co., Ind.	1,000,000	100	—	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	143	145
Madison Gas and Electric Co.				
" 1st Mtg. 6's	350,000	1,000	106	108¾
" 6 per cent. scrip, due 1910	100,000	25	60	60½

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DIVIDEND NOTICE.

OFFICE OF THE UNITED GAS IMPROVEMENT CO.,
N. W. CORNER BROAD AND ARCH STS.,
PHILADELPHIA, PA., March 10, 1909.

The Directors have this day declared a quarterly dividend of 2 per cent. (one dollar per share), payable April 15th, 1909, to stockholders of record at the close of business, March 31, 1909. Checks will be mailed.

1762-5 LEWIS LILLIE, Treasurer.

ANNUAL MEETING.

OFFICE OF THE UNITED GAS IMPROVEMENT CO.,
N. W. CORNER BROAD AND ARCH STS.,
PHILADELPHIA, February 15, 1909.

The Annual Meeting of the Stockholders of The United Gas Improvement Company will be held at the office of the Company, Northwest Corner of BROAD AND ARCH STREETS, PHILADELPHIA, on Monday, May 3, 1909, at 12 o'clock, NOON, for the purpose of electing a President and six Directors, to serve for the ensuing year, considering and acting upon the subject of a proposed increase in the capital stock of the Company from 918,006 shares of the par value of $50 each, to 1,000,467 shares of the par value of $50 each, and transacting such other business as may properly come before the meeting. The stock transfer books will be closed from 3 P.M., April 21, 1909, until 9 A.M., May 4, 1909. By order of the Board of Directors.

1759-5 W. F. DOUTHIRT, Secretary.

Position Wanted

As Manager or Superintendent,

By competent gas man, 35 years of age, married, strictly sober, with operating experience both as manager and superintendent in actual charge of plants. A man who can show and give results; 17 years' experience; now acting as manager of coal gas plant in city of 15,000. Will have to give present people 60 days' notice. Address,

1727-eot-tf "RESULTS," care this Journal.

Position Wanted

As Manager or Superintendent,

By a young married man, 8 years' practical experience in the manufacture and distribution of both coal and water gas. At present in charge of plant sending out 24,000,000 cubic feet Good office manager and hustler for new business.

Address, "C. E.,"

1764-2 Care this Journal.

Position Wanted

By a competent and reliable man, with 13 years of thorough, practical experience in all departments of the gas business; 33 years of age; married; strictly sober; good technical education, and one who can show good results. At present employed as manager in a city of 40,000 inhabitants. Can furnish first-class references from his present and past employers, as well as others. Willing to go anywhere, but the Far West or Pacific Coast preferred. Address, "BOX 24,"

1764-4 Care this Journal.

POSITION WANTED

As Working Foreman in Coal Gas Plant,

By a young man, in town of 10,000 to 20,000 inhabitants. Can give good references. Location in Middle West preferred.

1765-1 Address, "C. F.," care this Journal.

WANTED,

Position as Foreman in Retort House.

At present employed. Good reasons for changing. Address, "K. W.,"

1765-3 Care this Journal.

Position Wanted

As Manager or Superintendent of Coal or Water Gas Plant,

By competent man with practical operating experience in all departments, both as superintendent and mansger. Best of references. Open for engagement April 15, 1909.

1764-2 Address, "A. H. H.," care this Journal.

Position Wanted

As Superintendent,

By a competent gas man who has had practical experience in all branches of the business, both coal and water gas. At present employed. A-1 references.

1755-tf Address, "R. C.," care this Journal.

Position Wanted

As Superintendent or Manager.

Gas or electric property. Technical graduate. Experience. Best references.

1765-1 Address, "N. O. W.," care this Journal.

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Must have had 5 years' experience, furnish references and guarantee results. Preferably one now employed. All correspondence confidential. Salary expected. Address, "D.,"

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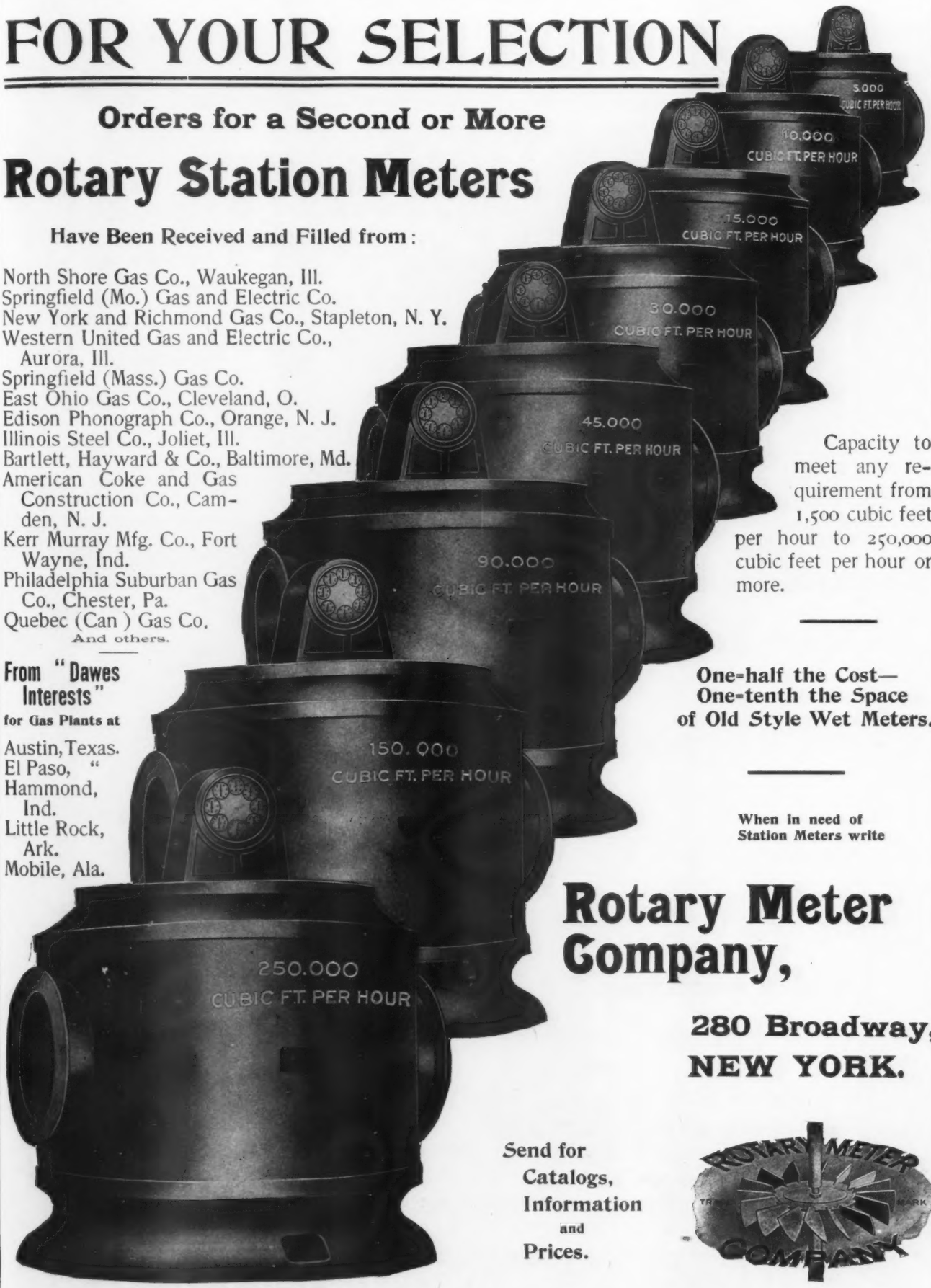
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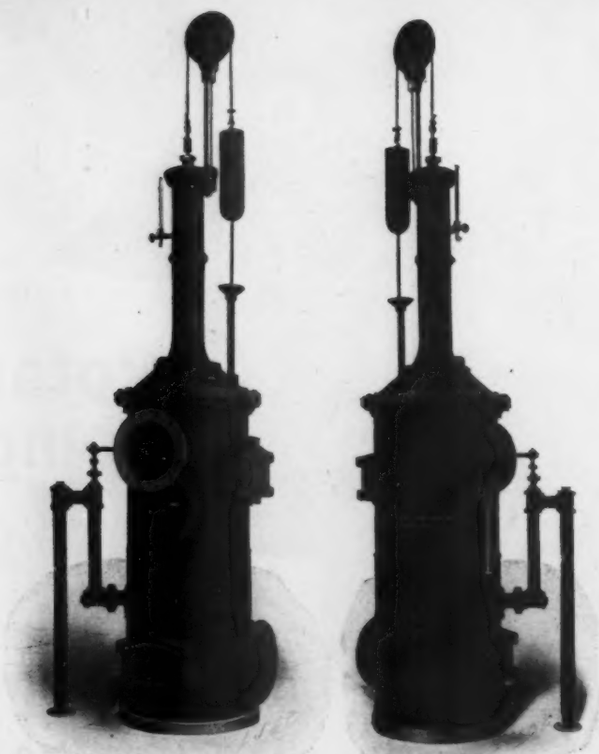

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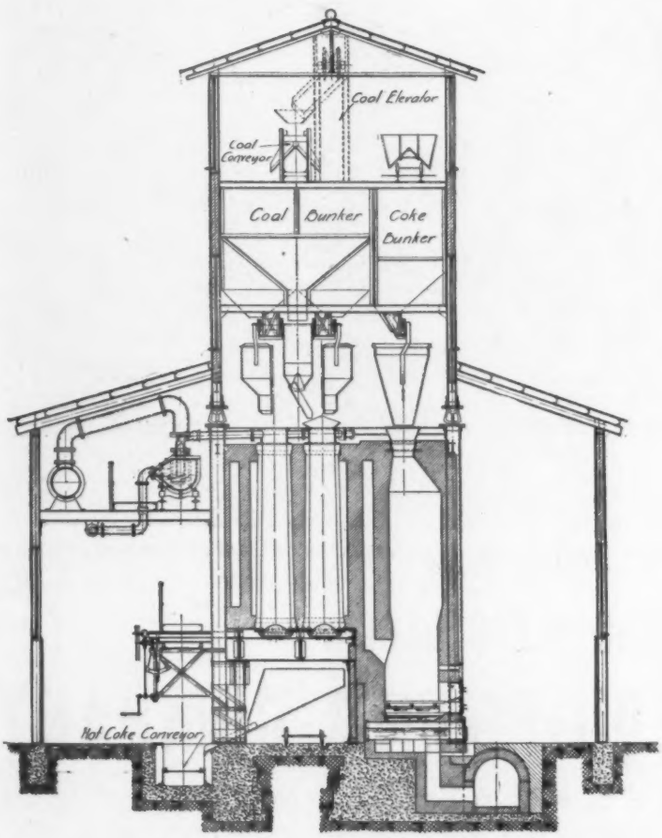

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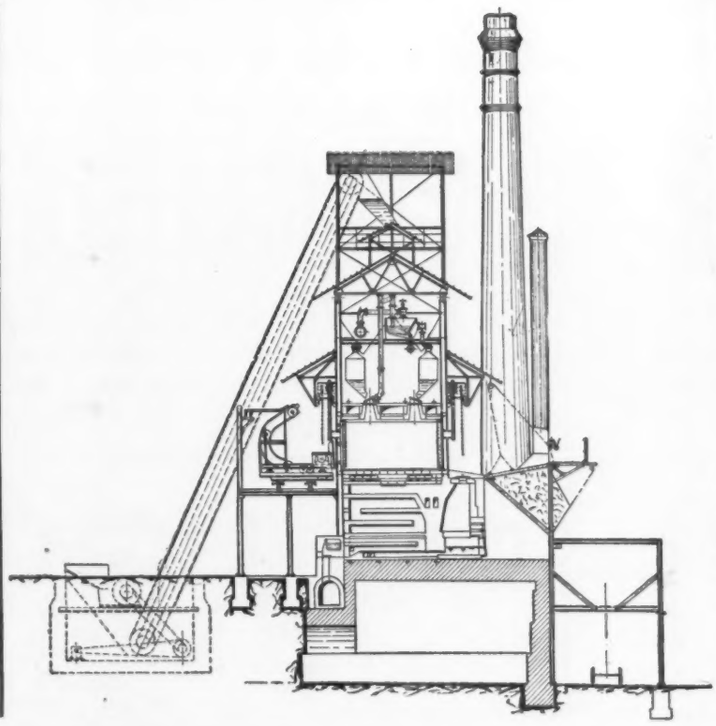

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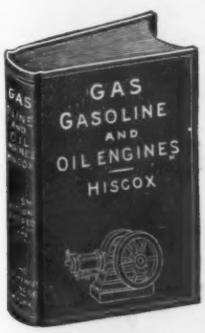

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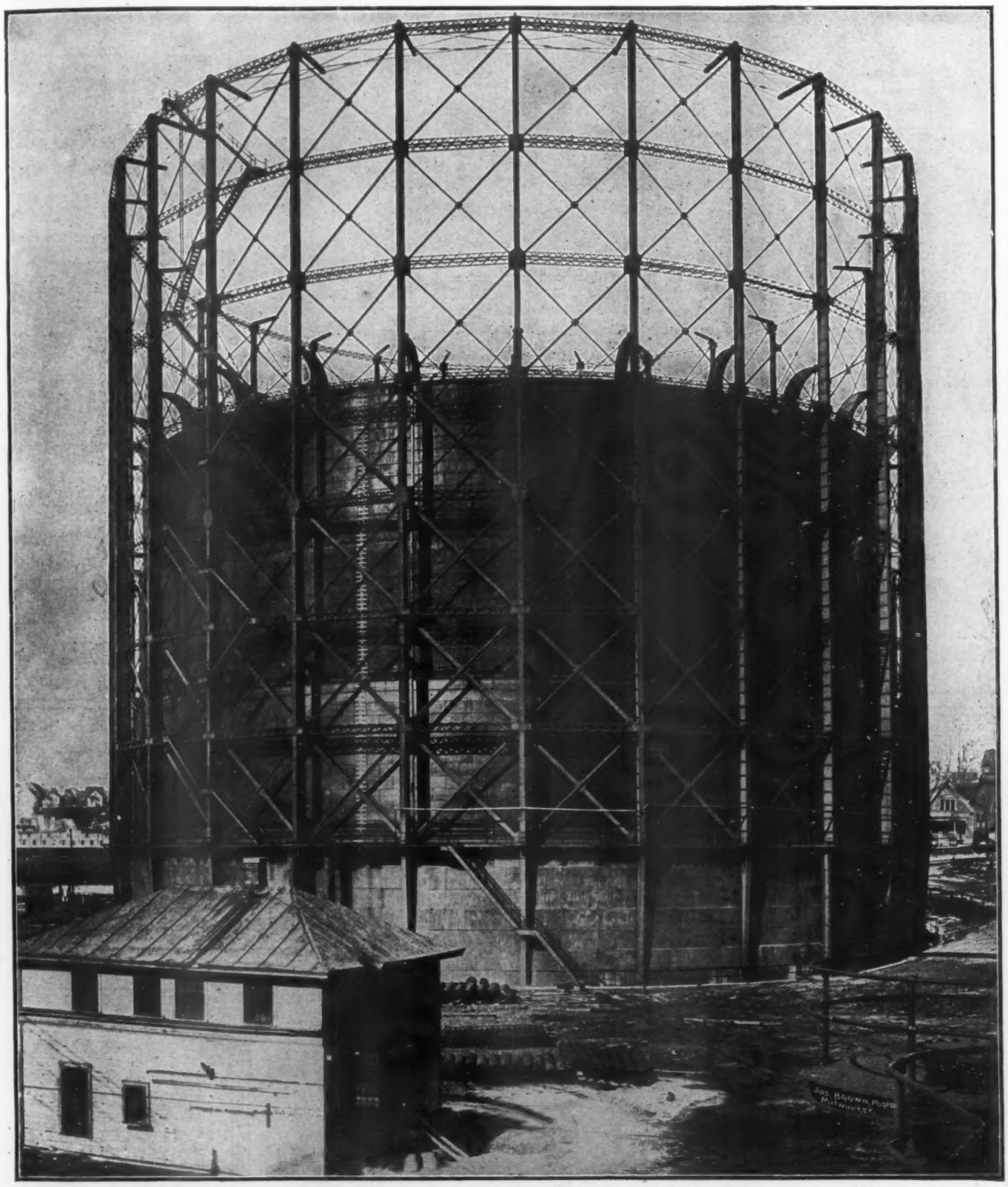

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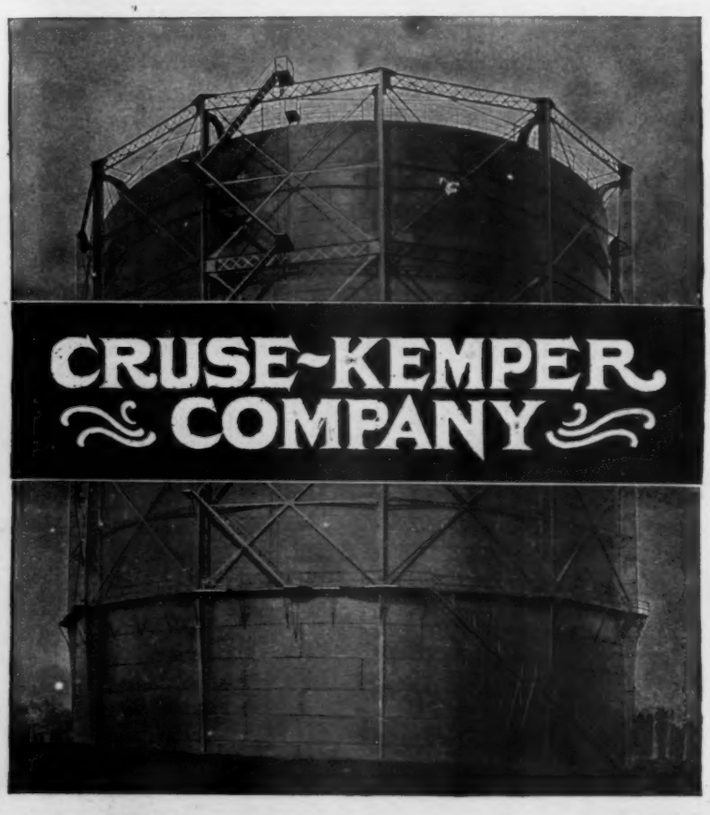

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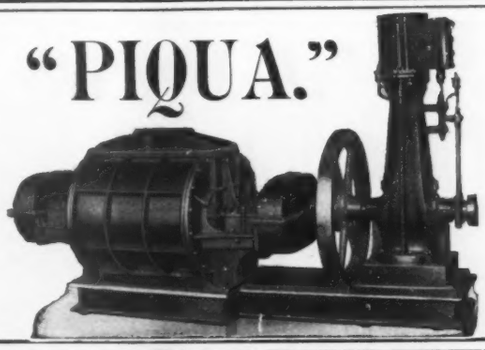

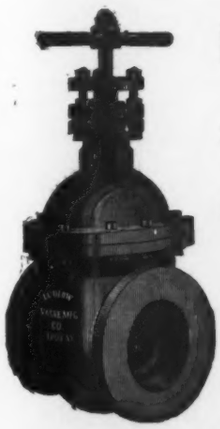

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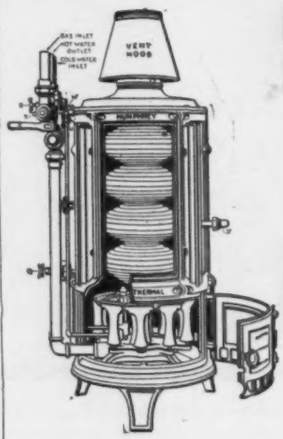

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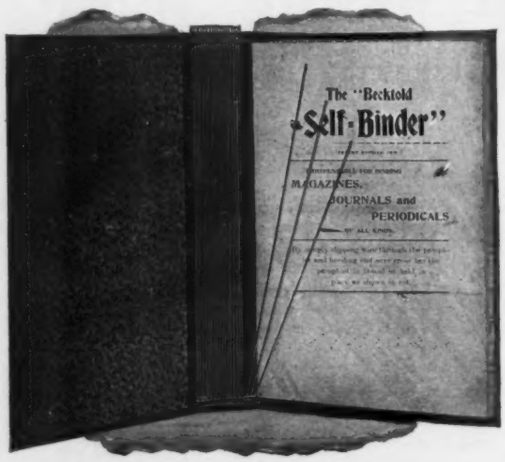

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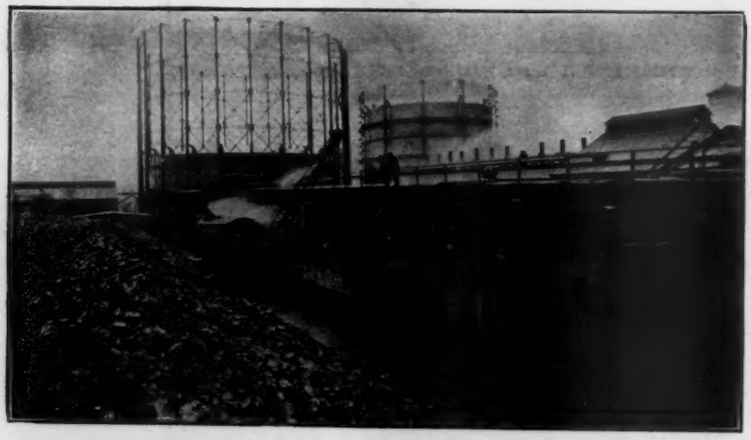

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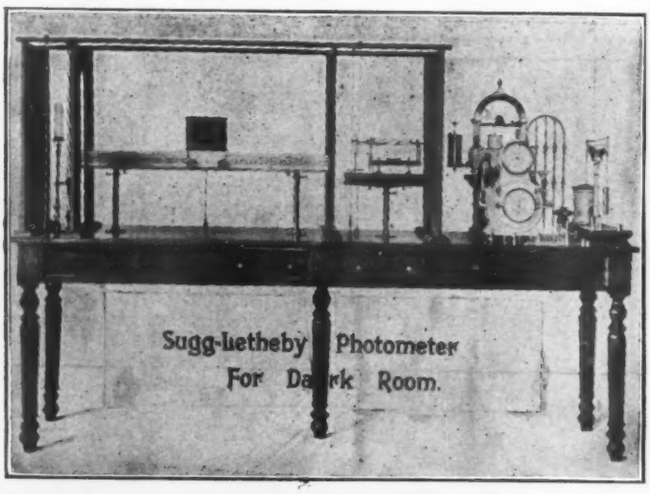
APRIL, 1909.

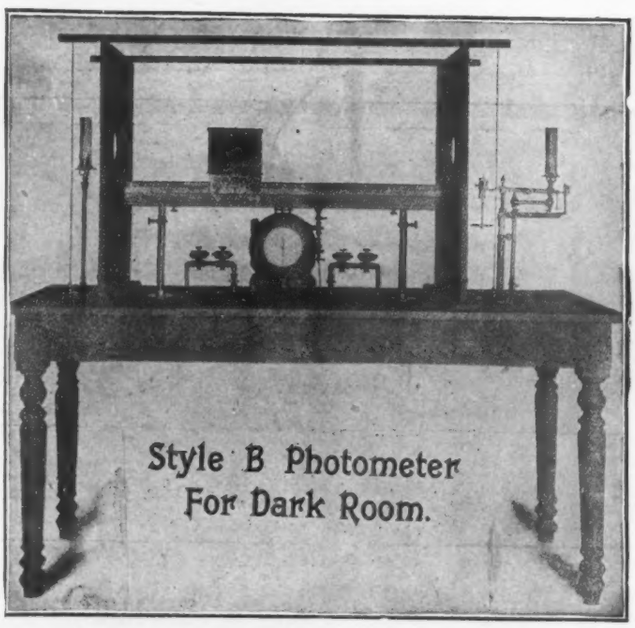
Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Extinguish.
Thu.	1	3.40AM	4.50AM
Fri.	2	4.10	4.50
Sat.	3	4.30	4.50
Sun.	4	No L.	No L.
Mon.	5	No L.FM	No L.
Tue.	6	No L.	No L.
Wed.	7	7.00PM	9.20PM
Thu.	8	7.00	10.20
Fri.	9	7.00	11.30
Sat.	10	7.00	12.30AM
Sun.	11	7.10	1.30
Mon.	12	7.10	2.30
Tue.	13	7.10LQ	3.20
Wed.	14	7.10	4.00
Thu.	15	7.10	4.20
Fri.	16	7.10	4.20
Sat.	17	7.10	4.20
Sun.	18	7.10	4.10
Mon.	19	7.10NM	4.10
Tue.	20	7.10	4.10
Wed.	21	7.10	4.10
Thu.	22	7.10	4.10
Fri.	23	7.10	4.10
Sat.	24	11.00	4.10
Sun.	25	11.50	4.00
Mon.	26	12.40AM FQ	4.00
Tue.	27	1.10	4.00
Wed.	28	1.40	4.00
Thu.	29	2.10	4.00
Fri.	30	2.30	4.00

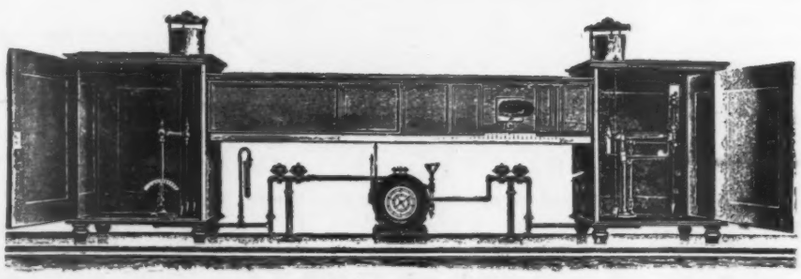
TOTAL HOURS DURING 1909.

By Table No. 1.

	Hrs.Min.
January	212.20
February	183.40
March	173.00
April	151.10
May	144.10
June	138.50
July	145.40
August	160.30
September	180.00
October	201.00
November	216.30
December	233.40
Total, yr.	2140.30







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PUBLIC LIGHTING TABLE.

APRIL, 1909.

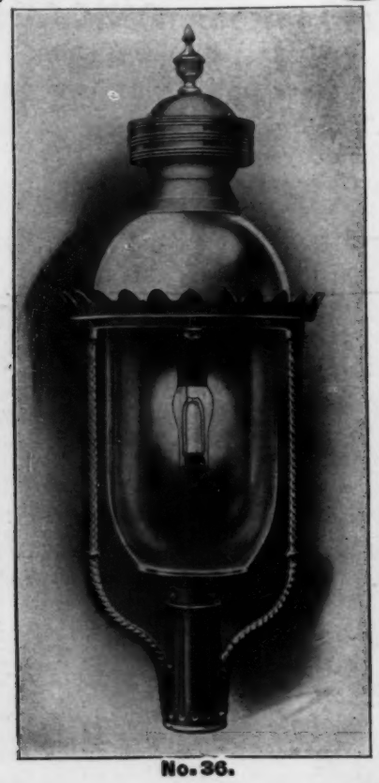
Day of Week.	Date.	Table No. 2. New York City. All Night Lighting. Complete Lighting in One Hour	Complete Extinguishing in 50 Minutes
		From Time Given	
		P. M.	A. M.
Thu.	1	5.57	4.47
Fri.	2	6.07	4.37
Sat.	3	6.07	4.37
Sun.	4	6.07	4.37
Mon.	5	6.07	4.37
Tue.	6	6.07	4.32
Wed.	7	6.07	4.32
Thu.	8	6.07	4.32
Fri.	9	6.17	4.22
Sat.	10	6.17	4.22
Sun.	11	6.17	4.22
Mon.	12	6.17	4.22
Tue.	13	6.17	4.22
Wed.	14	6.17	4.22
Thu.	15	6.17	4.22
Fri.	16	6.27	4.17
Sat.	17	6.27	4.17
Sun.	18	6.27	4.17
Mon.	19	6.27	4.12
Tue.	20	6.27	4.12
Wed.	21	6.27	4.12
Thu.	22	6.27	4.12
Fri.	23	6.37	4.02
Sat.	24	6.37	4.02
Sun.	25	6.37	4.02
Mon.	26	6.37	4.02
Tue.	27	6.37	4.02
Wed.	28	6.37	4.02
Thu.	29	6.37	4.02
Fri.	30	6.47	3.52

TOTAL HOURS DURING 1909.

	Hrs.Min.
January	428.30
February	358.15
March	353.10
April	298.10
May	263.20
June	234.45
July	248.30
August	278.00
September	311.25
October	370.05
November	397.40
December	438.35
	3980.25
Deduct on account of 50 min. extinguishing time	30.25
Total, yr.	3950.00

NEW YORK, 318 West 42d Street.
BOSTON, 820 Beacon Building.
PHILADELPHIA, Broad and Arch Streets.
ST. LOUIS, 712 Roe Building.
CHICAGO, 218 La Salle Street.
SAN FRANCISCO, 512 Oak Street.

WELSBACH STREET LIGHTING COMPANY



No. 36.

....OF AMERICA....

Controls and Operates the **Welsbach System of Street Lighting,**

Which includes its specially DESIGNED and PATENTED BURNER for PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in 150 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

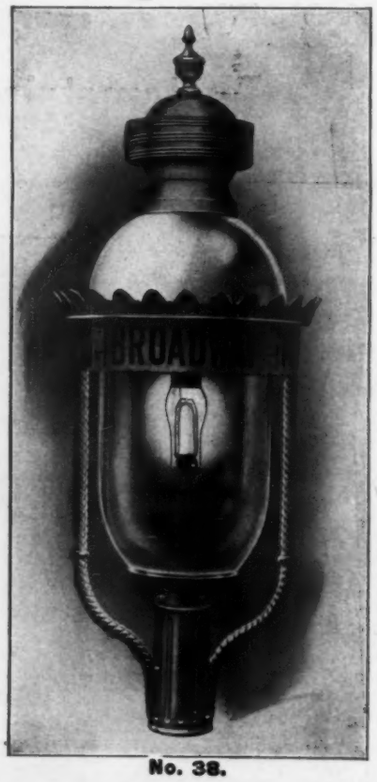
POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

Correspondence Solicited from Gas Companies and Others interested in Municipal and Outside Lighting.



No. 38.

Welsbach Junior

THE BIGGEST LITTLE LIGHT IN THE WORLD.

The Welsbach Junior Light is 5 inches high--consists of burner, mantle and chimney--and is attractively boxed in a pasteboard carton.

As its effectiveness and economy become better known the Welsbach Junior will supersede, for universal use in the home, the old-style open flame gas burners.

Gives 50-Candle Power.

Uses Two Feet of Gas per Hour.

Attaches to Any Gas Fixture.

Completely Hidden from View.

Use your own globe--either gas or electric.

Showing Welsbach Junior Light used in connection with ordinary glass globe.

SMALL—EFFICIENT—ECONOMICAL.

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OF THE

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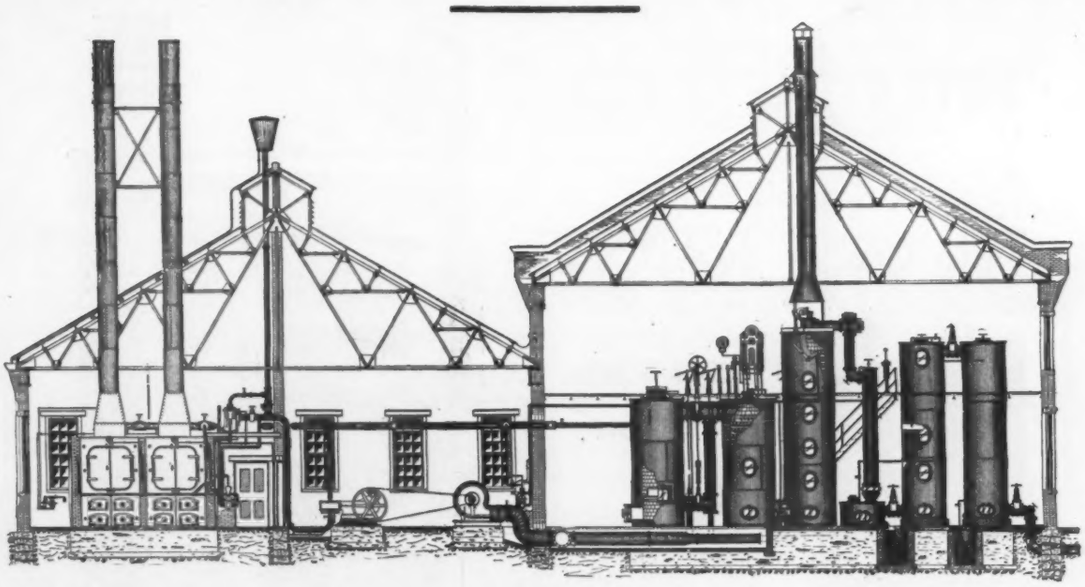

TOTAL SETS INSTALLED TO DECEMBER 31, 1908, ... 690
TOTAL DAILY CAPACITY, TO DECEMBER 31, 1908, ... 558,565,000 cu. ft.

Tar Extractors for Carburetted Water Gas.
Photometrical Apparatus.
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Straight Standpipe System for Coal Gas Retorts.
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ESTABLISHED 1868.

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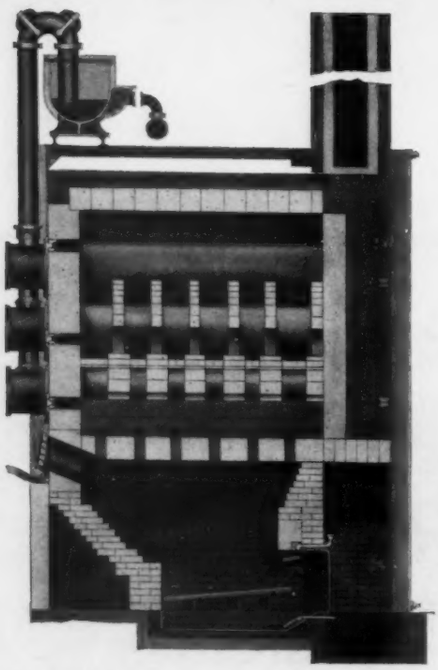

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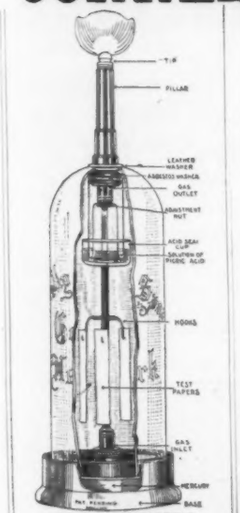

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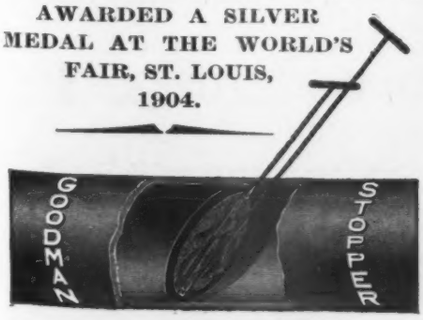

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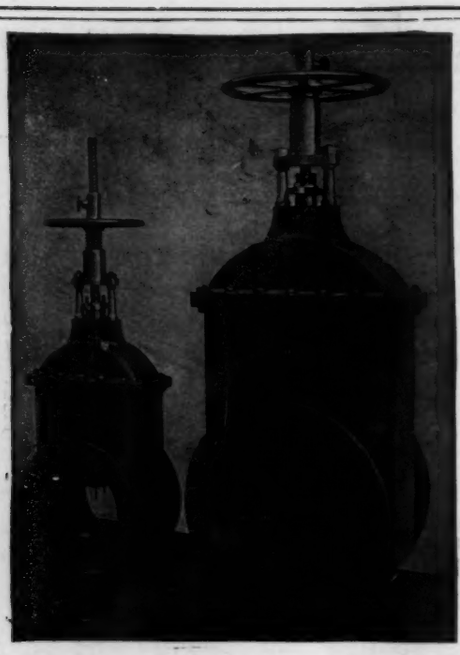

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Face to face of flange...	12 inches	12 inches	12 inches	14 inches	17 inches	20 inches	21 inches	23⅞ inches

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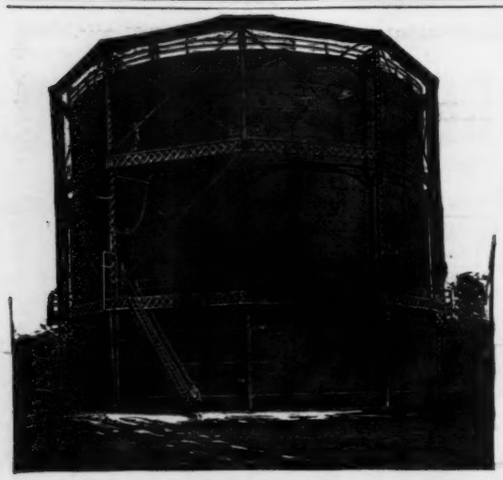

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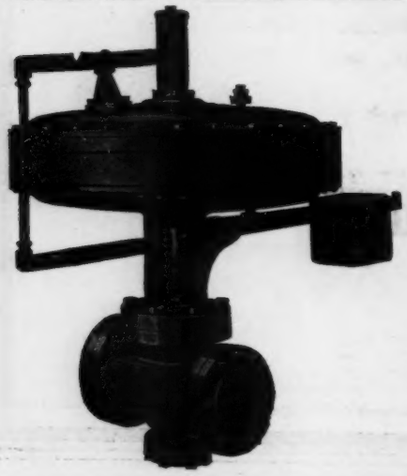

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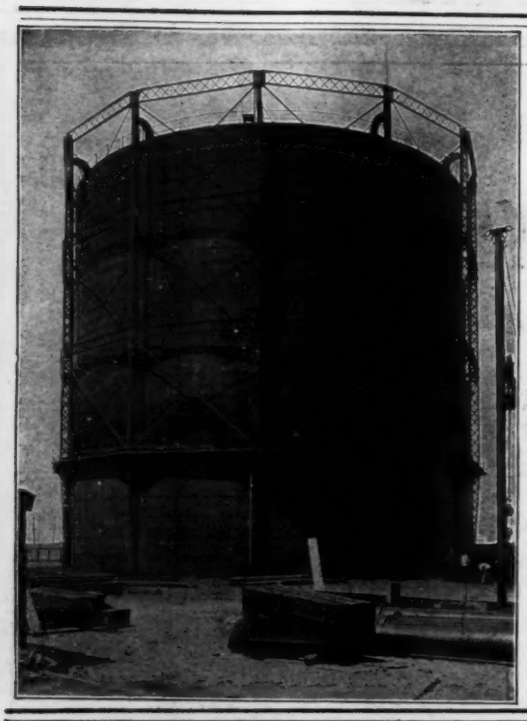

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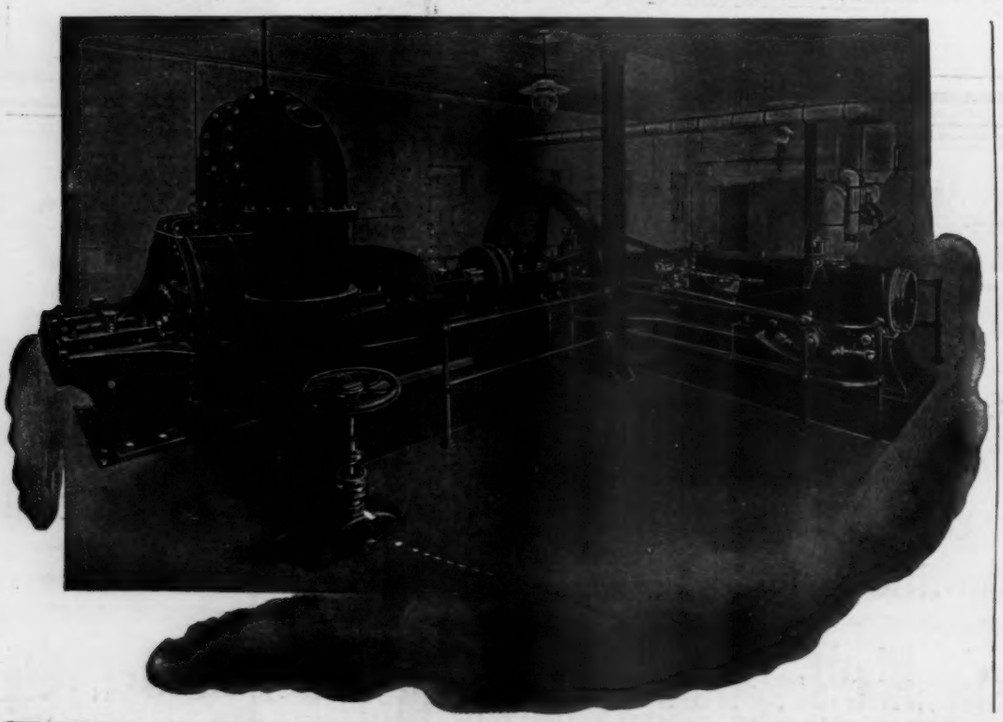

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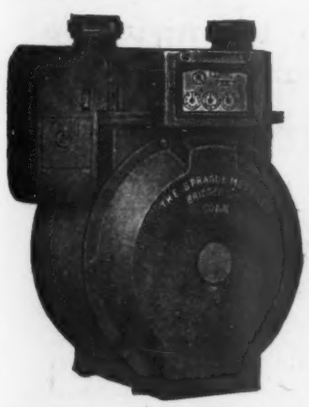

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